

## **Walnut River/Grouse Creek Watershed Modeling**

### Introduction

The Soil and Water Assessment Tool (SWAT), Version 2000 (Neitsch et al., 2001), a basin-scale model, was selected to process digital information to estimate average annual sediment yield, and nitrogen and phosphorus loading from the Walnut River/Grouse Creek watershed. SWAT (Arnold et al., 1993) is a basin-scale model "... developed to predict the impact of land management practices on water, sediment, and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods of time" (Neitsch et al., 2001). The model is physically based in that it requires specific information about weather, soil properties, topography, vegetation, and land management. SWAT is a continuous time model developed for long-term prediction, estimation, and frequency analysis. The SWAT model is a direct outgrowth of the SWRRB model (Williams et al., 1985; Arnold et al., 1990). Other models that contributed to the development of SWAT include CREAMS (Knisel, 1980), GLEAMS (Leonard et al., 1987), and EPIC (Williams et al., 1984).

GIS interfaces have been developed for the SWAT model (ArcView [ESRI, 1996a] and GRASS [CERL, 1988]) to facilitate the aggregation of input data for simulating large-scale basins (Srinivasan and Arnold, 1994). The ArcView graphical user interface for SWAT2000 (AVSWAT2000 [DiLuzio et al., 2001]) was selected for use in this application. The SWAT2000 ArcView extension evolved from an ArcView extension created for an earlier model version (SWAT99.2) of the model. The ArcView/SWAT interface allows the user to input raster-based map layers for soil information, land use and land cover, and digital elevation.

SWAT is a distributed hydrologic model that allows the division of a watershed into smaller subbasins to incorporate greater spatial detail. In applications of SWAT, hydrologic response units (HRUs) are created within each defined subbasin. By user direction, the SWAT interface creates HRUs for each land use and soil type combination that occurs within a subbasin. The HRUs do not have direct spatial significance beyond subbasin location and are created for calculation purposes, thus allowing the user to specify model parameters specific to the land use/soil type combinations existing within subbasins. The total export yield for a subbasin is the sum of export from all HRUs within it. Water, sediment, and nutrient yields from each subbasin are routed through a stream network to the watershed outlet(s) of the watershed. AVSWAT2000 includes routines for bacterial transport, and in-stream nutrient water quality simulation using equations from U. S. EPA's QUAL2E model (Brown and Barnwell, 1987).

After model calibration and validation, the constructed model can be used to estimate the potential effects of land management practices on pollutant (sediment, nutrients, bacteria) export from individual HRUs, subbasins, and the full watershed.

## Data Inputs

The Walnut River/Grouse Creek watershed (Figure 1) encompasses portions of nine Kansas counties in the southeastern quadrant of Kansas, and covers an area of approximately 624,800 hectares ( $2,412 \text{ mi}^2$ ). Areas in the watershed identified by Kansas state agencies (KDHE and KDWP) as high priorities for TMDL development and/or high biological priority are identified in Figure 2. Watershed modeling in the Walnut River/Grouse Creek watershed required spatially referenced digital data describing elevation, land use/cover, soil types and attributes, and weather. Digital stream location information, historical stream discharge from available gaging stations within the watershed, stream water quality water data, and water quality and storage data from upstream ponds and reservoirs were collected and manipulated for model input and calibration. Livestock types and densities (by county), and commercial fertilizer applications (by county), were collected and used as input to the model. Spatially referenced digital data was reprojected to a Universal Transverse Mercator projection (UTM [spheroid = GRS80, NAD 1983]). Throughout the following report metric measurements units are usually reported. Table 1 is a conversion table that can be used to convert metric units to U. S. measurement units.

Elevation: National Elevation Dataset (NED) digital elevation coverage from USGS (2000b) completely encompassing the Walnut River/Grouse Creek watershed in Kansas was acquired and patched together to form a seamless digital elevation model for the entire watershed at 30-meter resolution (Figure 3). The Walnut River/Grouse Creek watershed boundary and subbasin boundaries were generated from this digital elevation layer using ArcView Spatial Analyst software (ESRI, 1996b). USDA-NRCS (Kansas) developed 14-digit HUC boundaries for Kansas (available through the Kansas Data Access and Support Center [KS DASC, 2002]), and these boundaries were used as a template for the boundaries generated from the digital elevation data. Additional programs called by the GIS/model interface were used to extract unique runoff, stream, and topographic characteristics for each defined subbasin in the watershed from the digital elevation data.

Land Use/ Land Cover: USGS National Land Cover Data (NLCD) for Kansas (Kansas Land Cover Data Set [USGS, 2000a]) developed from recent (1987 – 1994) Landsat thematic mapper imagery, was acquired at 30-meter resolution. Descriptive classes in the coverage were renamed if necessary and/or aggregated to match land use categories within the internal SWAT land use/cover database. Additionally, riparian land use/cover data were obtained from USDA-NRCS (2001) through KS DASC. The riparian area data was combined with the Kansas NLCD data to create the land use/cover coverage used in the model (Figure 4). Ancillary data from TIGER files (county boundaries, hydrography, and roads [U. S. Department of Commerce, 2001]) were obtained for counties encompassing the watershed to enhance the land use/cover data layer. Based on the combined NLCD and riparian area inventory data, unmanaged grasslands account for 62.1% of the total area, croplands 18.5%, managed pasture/hay land 12.7%, forests 2.4%, and the remainder is distributed between other minor land uses (Table 2).

Soils: Kansas county digital soils data, obtained through KS DASC (2002), included SSURGO (USDA-NRCS, 1998) data for all nine counties encompassing the watershed at 30-meter resolution. Soils data from each county were patched together to create seamless soils coverage for the Walnut River/Grouse Creek watershed (Figure 5). Specific soil types were attributed by SOILS5 IDs, and soil characteristics (hydrologic soil group, bulk density, available water capacity, erosivity, etc.) were retrieved for each soil via a compiled soils database within the SWAT model. The five most frequent soil series, occurring in various associations in the basin, include Irwin, Labette, Dwight, Florence, and Verdigris. Associations including these soils occupy approximately 60% of the watershed area.

Weather: Weather data, including daily precipitation and daily minimum and maximum temperatures, were obtained for all available cooperative weather stations across the Walnut River/Grouse Creek watershed for the period of record through 2001 (Air Force Combat Climatology Center [AFCCC], 2001). Weather data for each potential station in the watershed were extracted for the longest possible coincident period of record (1948 – 2000) and formatted for input into the model. Data gaps (precipitation and/or temperature) at individual weather stations were filled using a weather generator within the SWAT model. The weather generator uses weather statistics from the nearest weather station located in the internal weather database to estimate daily precipitation and temperatures. Daily solar radiation, relative humidity, and wind speed were simulated using the internal weather generator. Locations of the weather stations are identified in Figure 6. Details regarding individual weather stations are presented in Table 3.

Streams, Discharge, and Water Quality: USGS National Hydrography Dataset digital data (USGS, 1999b), identifying stream locations and flow directions, were obtained for the Walnut River/Grouse Creek watershed area. Three 8-digit HUC data sets encompassing the basin (11030017 Upper Walnut, KS; 11030018 Lower Walnut, KS; and 11060001 Kaw Lake, OK) were obtained and patched together (Figure 7). The SWAT model incorporated these data along with digital elevation information to determine stream locations, stream connectivity, flow direction, and flow accumulation in the watershed.

Hydrologic calibration of the model required historical daily mean discharge data from unregulated gaging stations in the watershed. Historical discharge data from all available gaging stations in the watershed were obtained from the USGS (Figure 6 [USGS, 1999a]). A software program (BFI [Wahl and Wahl, 1996]) was used to process downloaded daily mean discharge data to estimate average annual base flow and surface runoff components of total discharge at each of the gaging stations for the period of record. These processed data were compared to SWAT simulated hydrologic output to determine the need for model parameter adjustments. Three USGS gages located in the watershed were deemed appropriate for hydrologic calibration based on period of record and location (07147070, 07146570, and 07147800). No stream gages, past or present, are located within the Grouse Creek watershed, limiting model calibration in that portion of the watershed. Detailed descriptive information for USGS gages located in the Walnut River/Grouse Creek watershed are presented in (Table 4). Inflow data to El Dorado Lake

(USACE, 2002) were collected and summarized on an average annual basis and used as an additional accuracy assessment of the hydrologic simulation.

Stream water quality data collected between 1985 and 2002 from eight sites within the basin (KDHE, 2002), and available USGS surface water quality data from four gaging sites were obtained and summarized on an annual basis for water quality calibration of the model. Locations of the KDHE stream water quality sites are included in Figure 6.

**Subbasin Definition:** The Walnut River/Grouse Creek watershed is defined by three 8-digit USGS hydrologic cataloging units (HUCs [Figure 7]) including 11030017 (Upper Walnut, KS), 11030018 (Lower Walnut, KS), and a portion of 11060001 (Kaw Lake, KS and OK). Each of these 8-digit HUCs was further subdivided into 14-digit HUCs that were used as the basis for subbasins modeled within SWAT. Template boundaries for the 14-digit HUCs were obtained from KS DASC (2002). Boundaries of 14-digit HUCs generated from the digital elevation data corresponded very closely with the template boundaries with only minor discrepancies. Most significant differences were deliberately created to delimit areas including and upstream of El Dorado Lake. The final product included 58 14-digit HUCs used as units for reporting sediment and nutrient loading predicted by the SWAT model (Figure 8). Further subdivision of some 14-digit watersheds was necessary so that model output could be generated at USGS gaging stations in the watershed for hydrologic calibration and comparison purposes (Table 5).

**Ponds and Reservoirs:** Data describing the location, drainage area, surface area, volume, inflows, outflows, and water quality of reservoirs and ponds are important for reliable sediment and nutrient export modeling. Data describing El Dorado Lake were obtained from USACE (USACE, 1993, 1998, and 2001). Other reservoir and pond data were estimated based on water surface areas in each subbasin from land use/cover digital coverages. Table 6 lists information describing El Dorado Lake, and estimated data for Winfield City Lake, incorporated into the SWAT model.

**Livestock, Fertilizers, and Land Management:** Information specifying livestock inventories and commercial fertilizer sales, by county, provided model input data related to nutrient and bacterial loading. Recent (1992) USDA agricultural census data (animal inventories) were obtained by county (Table 7 [Puckett et al., 1998]). Animal inventories in individual subbasins were estimated based on the fraction of subbasin area within a county. An animal waste characterization table (Table 8 [Lander and Moffit, 1998; USDA-SCS, 1992; and ASAE, 1991]) was used to estimate quantities of the nutrients nitrogen (N) and phosphorus (P) generated from animal waste in each county (Table 9). Rates of animal generated waste applied to individual subbasins were estimated using area-weighting methods based on the fraction of each subbasin within a county. Cattle were modeled as grazing on pasture and range lands for approximately two-thirds of each year.

Commercial fertilizer (N and P) use estimates for all counties in the watershed (Table 10) were obtained from Battaglin and Goolsby (1994). Rates of commercial fertilizer applications to crop and managed pasture land uses were calculated by county, and were

similarly distributed between the crop and pasture land uses within individual subbasins using area-weighting methods.

Modeled land management scenarios were relatively simplistic. Croplands were tilled (generic conservation tillage), planted, fertilized, and harvested on an annual basis. Managed pasture was fertilized and grazed on an annual basis. Rangeland was grazed on an annual basis. Input parameters determining grazing animal density were determined based on cattle inventories for each county. Foraging rates (dry matter) were estimated as 3% per day of average animal body weight (Ohio State University, 1998). Fecal coliform bacteria (FCB) density in beef manure (280 million colonies per kg manure) was estimated based on ASAE (1991) Manure Production and Characteristics data.

### Model Calibration

Hydrology: Mean annual total, base, and surface runoff discharge estimates from the SWAT model were adjusted to match, as closely as possible, the estimates made from historical discharge data at selected gaging stations with unregulated flow. A software program (BFI [Wahl and Wahl, 1996]) was used to estimate base flow and surface runoff contributions to measured stream discharge at USGS gaging stations with unregulated discharges. SWAT parameters adjusted to calibrate surface flow include the SCS Curve Number II for each land use/soil type combination ( $\pm 6\%$ ) and a soil evaporation compensation factor. Simulated base flow was calibrated by altering several inputs including the threshold depth of water in the shallow aquifer required for return flow to occur, and groundwater parameters affecting water movement from the shallow aquifer.

Three USGS gaging stations in the Walnut River/Grouse Creek watershed (USGS 07147070, 07146570, and 07147800) were determined to be acceptable sites for hydrologic calibration. Stream discharge at two sites (USGS 07147070 and 07146570) is (was) unregulated by upstream reservoirs, while the third (USGS 07147800), was determined to be sufficiently far downstream from El Dorado Lake to provide acceptable data for separation of surface and base flow contributions to total discharge. Adjustments were made to default SWAT model parameters iteratively to match simulated discharge with measured discharge at subbasin outflows corresponding to these gages. The adjustments to the model were designed to first calibrate surface runoff, and then base flow, based on comparison with processed measured mean daily flow data. Results of the calibration at the three unregulated sites are presented below in Table 11. The goal was to get simulated average annual discharge within 10% of measured average annual discharge over the available period of record. The annual relative differences in measured versus simulated total flows were within  $\pm 7\%$ . Simulated surface flows at all three gages were within  $\pm 5\%$  of measured flows. Simulated base flow at each of the three gages was within  $\pm 2\%$  of the calculated measured base flow. Graphic examples of calibration results at USGS 07147800 are presented in Figure 9 and Figure 10.

Included in Table 12 are total discharge comparisons for other gages in the watershed with flows regulated by upstream reservoirs, or discontinued gages with short periods of

record. Calibration was not performed at these other stations because either regulated upstream lake releases did not permit accurate estimation of base and surface components of total flow, or the available stream discharge period of record was limited. Simulated annual mean discharges at these gages differed from measured annual mean discharges by -7 to 12%.

Sediment and Nutrients: Water quality data from KDHE (2002) and USGS (1999a) were used to calibrate the model. KDHE TMDL data stations and USGS stations were identified by location within defined SWAT subbasins in the watershed for comparison purposes. Data acquired from KDHE and USGS were summarized on an annual basis by parameter and compared to corresponding locations in the constructed model. KDHE water quality data parameters included total Kjeldahl nitrogen, ammonia, nitrate, total phosphorus, total suspended sediment, and fecal coliform bacteria. Periods-of-record (POR) for individual KDHE TMDL stations, and parameters at stations, are variable and are summarized in Table 13. USGS water quality data at gaging stations in the watershed was reviewed for the same or similar parameters, extracted, and summarized by calendar year. Four USGS gages (07146570, 07147070, 07147100, and 07147800) had water quality data for one or all of the same parameters with varying PORs. This information is also summarized in Table 13. Data quantity limitations at calibration sites resulted in restricting calibration to attempt to produce simulated water quality parameter means that fell within  $\pm 1$  standard deviation of measured water quality parameter means.

Calibration of SWAT modeled water quality began with comparisons of total suspended concentrations at those locations where data were available. As suggested in the SWAT 2000 User's Manual (Neitsch et al., 2001), when hydrologic calibration is satisfactory, sediment contributions from HRUs and subbasins should be close to measured values. Graphic comparisons of measured and modeled means are presented in Figure 11 and Figure 12. Modeled nitrogen series means were close to, but generally higher than, measured means. Modeled phosphorus concentrations were also generally higher than measured means at most sites. Total suspended solids and fecal coliform bacteria modeled mean concentrations were within one SD of measured means at most stations, although the model carried higher concentrations of bacteria further downstream.

## Results

The calibrated SWAT model of the Walnut River/Grouse Creek watershed was run for a 53-year period based on the coincident period of record (1948 – 2000) of the available weather stations. The model simulated the currently available land use determinations and management throughout the simulation period. Reservoirs were modeled as hydrologic components with sediment and nutrient trapping functions, and the operational dates (month and year) of each reservoir were used as the beginning of reservoir functionality through the simulated period. Basin areas occupied by water (ponds and reservoirs) were not modeled as a land use, but were included in hydrologic, sediment, and nutrient export calculations.

Hydrologic response units (HRUs), land use and soil combinations within each subbasin, serve as basic functional units of the model. HRUs were defined as land uses accounting for at least 1% of subbasin area underlain by soils accounting for at least 10% of subbasin area. This resulted in 1,409 HRUs for the entire watershed, or an average of ~22 HRUs for each of the 65 subbasins that were defined in the SWAT model. Model output data was aggregated to reflect results for the 58 14-digit HUC watersheds in the Walnut River/Grouse Creek watershed.

Even with calibration of sediment and nutrient export in the SWAT model of the Walnut River/Grouse Creek watershed, reported estimates should be viewed in relative, rather than absolute, terms. Results identify the relative magnitude of subbasin and land use contributions to sediment yield and nutrient export.

Simulated average annual basin-wide precipitation was 870.2 mm (34.3 in.) over the 53-year period with 149.75-mm/yr (5.89 in/yr) surface runoff. Highest average annual runoff was predicted for several subbasins above El Dorado Lake (173-209 mm/yr) and lowest for subbasins along the lower mainstem of the Walnut River (94 - 113 mm/yr). Runoff carried an estimated annual average 0.67 metric tons (t) of sediment per hectare per year, 1.86-kg/ha/yr organic nitrogen (as N), 1.19-kg/ha/yr nitrate (as N), 0.42-kg/ha/yr organic phosphorus (as P), 0.05-kg/ha/yr soluble phosphorus (as P), and 0.25-kg/ha/yr sediment-bound phosphorus (as P).

Tabular summaries of simulated average annual export of sediment, organic nitrogen, nitrate, soluble phosphorus, and sediment-bound phosphorus by 14-digit HUC subbasin are presented in Table 14. The percent area of each of the 14-digit HUC subbasins identified and modeled as cropland correlates closely with estimated export of sediment, and sediment bound nutrients. Figure 13 indicates that subbasins in the northwestern and western portions of the Walnut River/Grouse Creek watershed are where cropland agriculture is more intensive. Basin maps indicating locations of subbasins and relative rates per unit area of average annual runoff, sediment export, nutrient yields, and concentrations of FCB in runoff are included in Figure 14 through Figure 21.

Table 15 lists the same sediment and nutrient export information for each subbasin broken down by contribution from the various land uses. Subbasins with a higher percentage of agricultural land uses (row crops) tend to have higher average annual sediment export rates. A similar pattern exists for nutrient export in the Walnut River/Grouse Creek basin. Subbasins with a greater percentage of land area designated as crop (row and close grown) tend to have higher average annual export rates.

Comparisons of average annual rates of runoff, sediment yield, nutrient export, and fecal coliform bacteria export, by land use, are given in Table 16. Highest runoff, nitrate, and soluble phosphorus export rates per unit area were estimated for urban land uses. Highest sediment, organic N and P, and FCB export per unit area were estimated for cropland uses.

Estimated land use contributions to sediment, nutrient, and FCB export are distinguished between the Walnut River Basin and the Grouse Creek Basin in Table 17. The Walnut River Basin, with higher percentages of land use devoted to cropland agriculture, and significant urban areas, was estimated to yield nearly twice as much sediment, organic N and P, and sediment bound phosphorus per unit area than the Grouse Creek Basin. The Grouse Creek Basin, dominated by rangeland use (77.6%), had no modeled urban areas. Cropland land use in the Grouse Creek Basin, accounting for about 7% of the area, was estimated to have higher average annual rates of sediment, organic nutrient, and sediment bound phosphorus export than the Walnut River Basin due in part differences in soil types.

Rates of sediment and nutrient export by land use, as discussed above, may aid in focusing management activities. It is also important to consider the area that each land use occupies in the basin to determine estimates of average annual loading. Average annual loads, calculated as rates of sediment and nutrient export by land use, multiplied by the area each land use occupies, are presented for the full Walnut River/Grouse Creek Watershed in Table 18. Cropland land uses, occupying just over 18% of the watershed area, are estimated to contribute 93% of the total average annual sediment yield in the watershed. Rangeland, occupying nearly 65% of the watershed area, contributes an estimated 5.7% of the average annual sediment load. Organic N and P, and sediment bound phosphorus loads follow similar patterns since these nutrient forms are primarily delivered to surface waters attached to sediment. Soluble nutrient loading contributions, nitrate and soluble phosphorus, were estimated to be dominated by rangeland and pasture land uses. Also calculated were annual average estimates of FCB counts by land use calculated from the estimated annual average concentration in runoff. Highest contributions to total average annual FCB loads were cropland (70%) and rangeland (25%).

Sediment and nutrient loads were also calculated separately for the Walnut River Basin and the Grouse Creek Basin (Table 19). Land use contribution to average annual sediment and nutrient loading in the Walnut River portion of the watershed is very similar to results for the full watershed. The Grouse Creek Basin, where land use is dominated by rangeland, is shown to have a higher percentage of sediment (19.2%), organic N and P (32 and 23 %, respectively), and sediment bound phosphorus (18%) loading contributed by rangeland. The highest contribution to average annual FCB count in the Grouse Creek Basin is also rangeland (51%).

FCB loadings, estimated based on average annual concentrations in average annual runoff quantities, are extremely large numbers. Figure 28 indicates the percentage of the calculated total watershed FCB load (count) contributed by each 14-digit HUC in the watershed. Highest contributions are estimated for the subbasins in the upper portions of the Whitewater River area and along the lower portion of the West Branch Whitewater River.

#### Potential Limitations and Significant Sources of Uncertainty

The SWAT nonpoint source model of the Walnut River/Grouse Creek Watershed is a system of equations that represent a simplification of real processes. Construction of the model, and its application, requires many assumptions. An essential component of any modeling project is to identify limitations and significant sources of uncertainty. For this application, the following are some issues that may add significantly to uncertainty of predictions:

- Errors in, and scale of, GIS data contribute significantly to uncertainty of modeled output. For example, topographic parameters were estimated using 30-meter resolution elevation data and were averaged over defined subbasins in the watershed. NLCD land use/cover classifications were based on Thematic Mapper imagery collected from 1988 to 1994. The agency (USGS) accuracy assessment of this data was still pending at the time of data acquisition. Initial soil nutrient concentrations were estimated based on soils database information since detailed soil test nutrient data was not acquired for the various land uses in the watershed.
- The functional modeling units of the SWAT model are combinations of specific land uses and soil types (HRUs) within hydrologically defined subbasins of the larger watershed. In order to reduce the complexity of the model, not every possible combination of land use and soil type is modeled. Certain land use/soil combinations, occupying subbasin land areas less than modeled restrictions may contribute significantly to sediment and nutrient export, and are ignored by the model.
- Weather data input into the model was collected at relatively few points in the basin. Rainfall can be highly variable, and the limited number of weather stations used in this study cannot effectively describe the actual variability.
- Accurate modeling of water bodies (ponds, streams, lakes and reservoirs) is critically important in accurately determining sediment and nutrient export, and this effort was limited by available information. While relatively good morphometric data was available for El Dorado Lake, other reservoir, and pond inputs (areas and morphometric data) were estimated based on digital land use/cover data.
- Calibration of sediment, nutrient, and FCB export was performed with limited field observations.
- The simulation models estimates of current land use and management conditions in the basin based on historical weather data. Model results do not represent a historical summary of sediment and nutrient export in the basin.
- Point source nutrient inputs were not included in the present modeling effort.
- Reported annual average values for runoff, sediment, nutrient, and FCB export are merely model estimates and likely have a high degree of error associated with

them. A higher degree of confidence can be placed in relative values. The model is not likely able to accurately predict ‘how much’ for any particular subbasin or watershed, but rather whether one subbasin’s output is higher or lower than another.

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**Table 1. Unit Conversions.**

|                                 |   |                                   |
|---------------------------------|---|-----------------------------------|
| 1 Hectare (ha)                  | = | 2.471 Acres (ac)                  |
| 1 Kilogram (kg)                 | = | 2.205 Pounds (lbs)                |
| 1 Metric ton (t) = 1000 kg      | = | 1.103 Short Tons (T)              |
| 1 Millimeter (mm)               | = | 0.0394 Inches (in)                |
| 1 Meter (m) = 1000 mm           | = | 3.281 Feet (ft)                   |
| 1 Kilometer (km) = 1000 m       | = | 0.6214 Miles (mi)                 |
| 1 Kilogram per hectare (kg/ha)  | = | 0.8924 Pounds per acre (lb/ac)    |
| 1 Metric ton per hectare (t/ha) | = | 0.4462 Short Tons per acre (T/ac) |
| 1 hectare-meter (ha-m)          | = | 8.104 acre-feet (ac-ft)           |
| 1 Cubic meter per second (cms)  | = | 35.31 Cubic feet per second (cfs) |

**Table 2.** Land use/cover in the Walnut River/Grouse Creek Watershed derived from USGS NLCD, USDA-NRCS Riparian Areas Inventory, and ancillary data, and corresponding SWAT model land use codes.

| Description                          | SWAT Land Use Code | Modeled as ...                            | Area (ha) | Area (ac) | Percent Cover |
|--------------------------------------|--------------------|---|-----------|-----------|---------------|
| Open Water                           | ---                | Reservoirs and ponds                      | 12,251    | 30,272    | 1.96          |
| Low Density Residential              | URLD               | Urban, low intensity residential          | 3,866     | 9,553     | 0.62          |
| Medium Density Residential           | URMD               | Urban, medium intensity residential       | 518       | 1,280     | 0.08          |
| High Density Residential             | URHD               | Urban, high intensity residential         | 1,164     | 2,876     | 0.19          |
| Commercial/Industrial/Transportation | UCOM               | Urban, commercial and industrial property | 2,485     | 6,140     | 0.40          |
| Bare Rock/Sand/Clay                  | BARE               | Bare soil/rock                            | 204       | 504       | 0.03          |
| Quarries/Strip Mines/Gravel Pits     | BARE               | Bare soil/rock                            | 117       | 289       | 0.02          |
| Deciduous Forest                     | FRSD               | Deciduous Forest                          | 2,260     | 5,584     | 0.36          |
| Evergreen Forest                     | FRSE               | Evergreen Forest                          | 116       | 287       | 0.02          |
| Mixed Forest                         | FRST               | Mixed Forest                              | 12,802    | 31,634    | 2.05          |
| Shrubland                            | RNGB               | Brushy Range                              | 14,983    | 37,023    | 2.40          |
| Grasslands/Herbaceous                | RNGE               | Range                                     | 373,057   | 921,824   | 59.71         |
| Pasture/Hay                          | PAST               | Pasture, managed And/or improved          | 79,347    | 196,066   | 12.70         |
| Row Crops                            | AGRR               | Cropland, row crops                       | 48,455    | 119,732   | 7.76          |
| Small Grains                         | AGRC               | Cropland, close grown                     | 50,915    | 125,811   | 8.15          |
| Generic Agriculture                  | AGRL               | General agriculture                       | 16,199    | 40,028    | 2.59          |
| Urban/Recreational Grasses           | BERM               | Grass, bermuda                            | 2,444     | 6,039     | 0.39          |
| Woody Emergents                      | WETF               | Woody wetland                             | 35        | 86        | 0.01          |
| Emergent Herbaceous Wetlands         | WETN               | Herbaceous wetland                        | 3,576     | 8,836     | 0.57          |
| Animal Production                    | CAFO               | Animal Production                         | 6         | 15        | 0.00          |
| Total                                |                    |   | 624,800   | 1,543,879 | 100           |

**Table 3.** Weather stations in and near the Walnut River/Grouse Creek Watershed with daily precipitation and temperature data.

| Station ID | Name                 | Longitude | Latitude | Elevation |       | POR         | County, State |
|------------|----------------------|-----------|----------|-----------|-------|-------------|---------------|
|            |                      |           |          | (m)       | (ft)  |             |               |
| 140313     | Arkansas City        | -97.03    | 37.08    | 326       | 1,070 | 1948 - 2001 | Cowley, KS    |
| 140424     | Atlanta              | -96.77    | 37.43    | 439       | 1,440 | 1953 - 2001 | Cowley, KS    |
| 140447     | Augusta              | -96.98    | 37.67    | 372       | 1,221 | 1948 - 2001 | Butler, KS    |
| 141173     | Burns                | -96.88    | 38.08    | 458       | 1,503 | 1975 - 2001 | Marion, KS    |
| 141239     | Cambridge            | -96.65    | 37.30    | 424       | 1,391 | 1982 - 2001 | Cowley, KS    |
| 141351     | Cassoday             | -96.62    | 38.03    | 445       | 1,460 | 1948 - 2001 | Butler, KS    |
| 142401     | El Dorado            | -96.85    | 37.82    | 393       | 1,289 | 1904 - 2001 | Butler, KS    |
| 142773     | Florence             | -96.93    | 38.25    | 384       | 1,260 | 1948 - 2001 | Marion, KS    |
| 143248     | Grenola 1 N          | -96.45    | 37.35    | 339       | 1,112 | 1948 - 2001 | Elk, KS       |
| 145069     | Matfield Green 2 N   | -96.57    | 38.17    | 412       | 1,352 | 1952 - 2001 | Chase, KS     |
| 145744     | Newton 2 SW          | -97.33    | 38.05    | 442       | 1,450 | 1939 - 2001 | Harvey, KS    |
| 146169     | Oxford               | -97.17    | 37.28    | 354       | 1,161 | 1948 - 2001 | Sumner, KS    |
| 146524     | Potwin 2 SW          | -97.02    | 37.93    | 409       | 1,342 | 1953 - 2001 | Butler, KS    |
| 146979     | Rosalia              | -96.62    | 37.82    | 464       | 1,522 | 1953 - 2001 | Butler, KS    |
| 147313     | Sedgwick 1 W         | -97.43    | 37.92    | 421       | 1,381 | 1948 - 2001 | Harvey, KS    |
| 148830     | Wichita Mid-Cntnt AP | -97.43    | 37.65    | 403       | 1,322 | 1948 - 2001 | Sedgwick, KS  |
| 148964     | Winfield No. 1       | -97.00    | 37.25    | 366       | 1,201 | 1948 - 2001 | Cowley, KS    |

**Table 4.**      **USGS gaging stations in the Walnut River/Grouse Creek Watershed.**

| USGS ID  | Description                                | Latitude  | Longitude | Drainage Area (mi <sup>2</sup> ) | Gage Datum (ft) (NGDV29) | POR       | Calibration Gage (Y or N) |
|----------|--|-----------|-----------|----------------------------------|--------------------------|-----------|---------------------------|
| 07146570 | Cole Creek near DeGraff, KS                | 37°56'50" | 96°46'50" | 30                               | 1,332.83                 | 1961-1981 | Y                         |
| 07146830 | Walnut River at Hwy 54 E. of El Dorado, KS | 37°49'01" | 96°50'21" | 350                              | 1,258.46                 | 1981-1998 | N                         |
| 07146990 | Whitewater River 3 Miles S of Potwin, KS   | 37°53'52" | 97°02'43" | 162                              | ?                        | 1967-1969 | N                         |
| 07147050 | WB Whitewater River near Furley, KS        | 37°52'08" | 97°07'31" | 88                               | 1,288.33                 | 1967-1969 | N                         |
| 07147060 | WB Whitewater River near Benton, KS        | 37°49'01" | 97°04'50" | 177                              | 1,259.76                 | 1967-1969 | N                         |
| 07147070 | Whitewater River at Towanda, KS            | 37°47'45" | 97°00'45" | 426                              | 1,231.47                 | 1961-2001 | Y                         |
| 07147100 | Whitewater River at Augusta, KS            | 37°44'20" | 97°00'30" | 456                              | ?                        | 1951-1955 | N                         |
| 07147800 | Walnut River at Winfield, KS               | 37°13'27" | 96°59'40" | 1,880                            | 1,082.86                 | 1921-2001 | Y                         |

**Table 5. USGS 14-Digit HUC watersheds in the Walnut River/Grouse Creek Watershed and corresponding SWAT subbasins.**

| 14-Digit HUC   | Centroid (NAD 83) |              | Area     |        | Elevation       |                 | SWAT Sub # |
|----------------|-------------------|--------------|----------|--------|-----------------|-----------------|------------|
|                | Longitude         | Latitude     | Hectares | Acres  | Min. Feet (MSL) | Max. Feet (MSL) |            |
| 11030017010010 | 97:12:07.78W      | 38:03:15.95N | 14.720   | 36.370 | 1,339           | 1,499           | 1          |
| 11030017010020 | 97:11:47.41W      | 37:57:27.21N | 9.950    | 24.590 | 1,283           | 1,519           | 4, 14      |
| 11030017010030 | 97:12:20.00W      | 37:55:45.51N | 9.980    | 24.660 | 1,273           | 1,513           | 5          |
| 11030017010040 | 97:08:00.17W      | 37:49:38.43N | 14.440   | 35.690 | 1,234           | 1,473           | 10, 11     |
| 11030017020010 | 97:05:34.14W      | 38:03:06.83N | 9.090    | 22.460 | 1,309           | 1,499           | 2          |
| 11030017020020 | 97:00:21.76W      | 38:04:05.88N | 13.480   | 33.320 | 1,306           | 1,499           | 3          |
| 11030017020030 | 96:57:58.59W      | 38:00:58.99N | 12.960   | 32.020 | 1,273           | 1,529           | 6          |
| 11030017020040 | 97:03:59.42W      | 37:58:00.65N | 7.090    | 17.510 | 1,266           | 1,460           | 7, 8       |
| 11030017020050 | 96:58:40.96W      | 37:55:25.41N | 8.780    | 21.680 | 1,247           | 1,499           | 9          |
| 11030017020060 | 97:00:38.82W      | 37:52:03.52N | 10.900   | 26.940 | 1,224           | 1,463           | 12         |
| 11030017020070 | 97:01:11.19W      | 37:44:30.52N | 12.460   | 30.800 | 1,201           | 1,411           | 13, 16     |
| 11030017020080 | 97:06:24.71W      | 37:43:28.03N | 12.020   | 29.710 | 1,184           | 1,437           | 19         |
| 11030017030010 | 96:39:22.92W      | 38:00:56.22N | 15.880   | 39.250 | 1,322           | 1,572           | 29         |
| 11030017030020 | 96:39:14.57W      | 38:00:56.33N | 7.910    | 19.540 | 1,339           | 1,522           | 30         |
| 11030017030030 | 96:39:33.85W      | 37:57:54.55N | 9.960    | 24.610 | 1,335           | 1,562           | 28         |
| 11030017030040 | 96:38:53.44W      | 37:54:52.95N | 8.270    | 20.440 | 1,326           | 1,539           | 27         |
| 11030017030050 | 96:46:11.13W      | 37:50:57.60N | 11.400   | 28.180 | 1,342           | 1,631           | 26         |
| 11030017030060 | 96:44:00.22W      | 37:54:36.82N | 10.020   | 24.760 | 1,273           | 1,470           | 24         |
| 11030017030070 | 96:52:26.14W      | 37:48:19.14N | 7.020    | 17.340 | 1,263           | 1,522           | 23         |
| 11030017040010 | 96:52:52.46W      | 37:59:23.09N | 10.750   | 26.570 | 1,335           | 1,522           | 25         |
| 11030017040020 | 96:51:56.02W      | 37:52:40.64N | 9.580    | 23.670 | 1,263           | 1,460           | 22         |
| 11030017040030 | 96:51:40.14W      | 37:46:58.50N | 11.420   | 28.220 | 1,221           | 1,421           | 21         |
| 11030017040040 | 97:09:40.01W      | 37:43:02.19N | 15.370   | 37.970 | 1,188           | 1,450           | 17, 18     |
| 11030018010010 | 97:04:56.11W      | 37:40:40.30N | 9.760    | 24.120 | 1,237           | 1,434           | 15         |
| 11030018010020 | 96:59:20.55W      | 37:39:44.68N | 9.200    | 22.740 | 1,168           | 1,388           | 20         |
| 11030018010030 | 96:38:44.08W      | 37:36:23.95N | 7.050    | 17.420 | 1,152           | 1,342           | 37         |
| 11030018010040 | 96:37:31.76W      | 37:46:12.75N | 14.940   | 36.920 | 1,326           | 1,641           | 31         |
| 11030018010050 | 96:48:20.56W      | 37:41:24.68N | 10.320   | 25.510 | 1,329           | 1,660           | 32         |
| 11030018010060 | 96:36:53.61W      | 37:40:32.53N | 12.160   | 30.050 | 1,211           | 1,473           | 34         |
| 11030018010070 | 96:46:23.37W      | 37:37:02.60N | 13.210   | 32.640 | 1,342           | 1,677           | 33         |
| 11030018010080 | 96:57:11.51W      | 37:37:36.61N | 13.120   | 32.420 | 1,211           | 1,572           | 35         |
| 11030018010090 | 96:56:55.11W      | 37:35:38.41N | 6.460    | 15.960 | 1,158           | 1,348           | 36         |
| 11030018020010 | 97:06:09.09W      | 37:31:51.35N | 12.110   | 29.930 | 1,139           | 1,473           | 40         |
| 11030018020020 | 97:06:28.58W      | 37:32:26.41N | 11.110   | 27.450 | 1,139           | 1,391           | 41         |
| 11030018020030 | 96:39:48.01W      | 37:30:03.64N | 12.720   | 31.420 | 1,132           | 1,381           | 42         |
| 11030018020040 | 96:48:00.06W      | 37:31:48.32N | 10.970   | 27.110 | 1,309           | 1,673           | 38         |
| 11030018020050 | 96:54:53.24W      | 37:31:01.32N | 11.920   | 29.460 | 1,221           | 1,581           | 39         |
| 11030018020060 | 97:00:17.69W      | 37:28:43.31N | 11.890   | 29.390 | 1,135           | 1,401           | 43         |
| 11030018020070 | 97:02:19.19W      | 37:27:04.29N | 7.370    | 18.220 | 1,122           | 1,342           | 44         |
| 11030018030010 | 96:42:01.91W      | 37:22:22.59N | 9.150    | 22.620 | 1,099           | 1,352           | 45         |
| 11030018030020 | 96:51:3.28W       | 37:26:06.90N | 9.560    | 23.610 | 1,306           | 1,558           | 46         |
| 11030018030030 | 96:50:35.69W      | 37:22:31.77N | 8.130    | 20.080 | 1,165           | 1,431           | 47, 48     |
| 11030018030040 | 96:54:20.20W      | 37:24:44.61N | 13.590   | 33.590 | 1,168           | 1,480           | 49         |
| 11030018030050 | 97:02:08.72W      | 37:17:26.27N | 10.240   | 25.300 | 1,093           | 1,398           | 50         |
| 11030018030060 | 96:56:07.67W      | 37:17:22.14N | 10.010   | 24.730 | 1,079           | 1,319           | 51         |
| 11030018030070 | 96:58:17.94W      | 37:13:33.58N | 12.810   | 31.660 | 1,070           | 1,381           | 59         |
| 11030018030080 | 96:59:08.70W      | 37:10:08.02N | 7.590    | 18.760 | 1,060           | 1,303           | 60         |
| 11030018030090 | 96:47:25.17W      | 37:05:22.23N | 9.560    | 23.630 | 1,040           | 1,312           | 63, 64     |
| 11060001010010 | 96:50:18.66W      | 37:16:51.95N | 13.520   | 33.420 | 1,161           | 1,463           | 58         |
| 11060001010020 | 96:32:55.52W      | 37:09:06.01N | 9.390    | 23.200 | 1,056           | 1,371           | 61         |
| 11060001020010 | 96:36:12.52W      | 37:30:34.75N | 12.660   | 31.280 | 1,312           | 1,647           | 52         |
| 11060001020020 | 96:37:18.35W      | 37:25:19.56N | 10.560   | 26.090 | 1,253           | 1,595           | 53         |
| 11060001020030 | 96:41:12.00W      | 37:21:10.76N | 12.580   | 31.080 | 1,214           | 1,585           | 54         |
| 11060001020040 | 96:41:59.05W      | 37:16:06.86N | 11.830   | 29.230 | 1,145           | 1,450           | 55         |
| 11060001020050 | 96:41:29.08W      | 37:11:21.14N | 9.480    | 23.420 | 1,112           | 1,431           | 56         |
| 11060001020060 | 96:48:22.27W      | 37:07:46.91N | 11.190   | 27.660 | 1,116           | 1,450           | 57         |
| 11060001020070 | 96:52:51.86W      | 37:07:09.02N | 7.570    | 18.700 | 1,053           | 1,381           | 62         |
| 11060001020080 | 96:52:51.86W      | 37:02:34.08N | 7.600    | 18.770 | 1,020           | 1,309           | 65         |

**Table 6.** Pertinent data for reservoirs in the Walnut River/Grouse Creek Watershed.

| Lake Name          | Operational Date | Area Flood Pool (ha) | Volume Flood Pool (ha-m) | Area Conservation Pool (ha) | Volume Conservation Pool (ha-m) | Municipal Water Use (ha-m/mon) |
|--------------------|------------------|----------------------|--------------------------|-----------------------------|---------------------------------|--------------------------------|
| El Dorado Lake     | June-81          | 4,847                | 30,465                   | 3,399                       | 19,982                          | 252.14                         |
| Winfield City Lake | ?                | 686*                 | 4,706*                   | 457*                        | 2,789*                          | 35.19*                         |

Data from USACE (1993) and USACE (2001). \*Estimates based on land use/cover data.

**Table 7.** Livestock inventory estimates in counties within the Walnut River/Grouse Creek Watershed.

| County    | FIPS Code | Cattle/calves Inventory | Hogs/pigs Inventory | Sheep/lambs Inventory | Horses Inventory |
|-----------|-----------|-------------------------|---------------------|-----------------------|------------------|
| Butler    | 20015     | 120,671                 | 42,266              | 6,672                 | 1,631            |
| Chase     | 20017     | 53,943                  | 8,999               | 430                   | 513              |
| Cowley    | 20035     | 68,944                  | 29,581              | 2,986                 | 802              |
| Elk       | 20049     | 40,784                  | 7,915               | 570                   | 382              |
| Greenwood | 20073     | 78,420                  | 3,133               | 829                   | 559              |
| Harvey    | 20079     | 35,396                  | 23,543              | 5,392                 | 465              |
| Marion    | 20115     | 75,985                  | 31,358              | 4,021                 | 426              |
| Sedgwick  | 20173     | 37,130                  | 17,469              | 13,646                | 1,499            |
| Sumner    | 20191     | 41,525                  | 18,299              | 10,244                | 536              |

1992 USDA-NASS (1995) data from Puckett et al. (1998).

**Table 8.** Animal waste characterization.

|                              | Beef<br>Per 1000 kg | Swine<br>Per 1000 kg | Sheep<br>Per 1000 kg | Horse<br>Per 1000 kg |
|------------------------------|---------------------|----------------------|----------------------|----------------------|
| Manure (fresh) Weight (kg/d) | 58                  | 80.5                 | 40                   | 51                   |
| Nitrogen as N (kg/d)         | 0.32                | 0.45                 | 0.45                 | 0.3                  |
| Phosphorus as P (kg/d)       | 0.098               | 0.135                | 0.08                 | 0.071                |
| N Available (Fraction)       | 0.5                 | 0.25                 | 0.5                  | 0.5                  |
| P Available (Fraction)       | 1                   | 1                    | 1                    | 1                    |

Average animal weights: beef, 420 kg; swine, 50 kg; sheep, 27 kg; and horse, 450 kg.

Data from Lander and Moffit (1998), USDA-SCS (1992), and ASAE (1991).

**Table 9.** Estimates of livestock generated nitrogen and phosphorus for counties within the Walnut River/Grouse Creek Watershed.

| County    | FIPS Code | Animal Manure       |        | Animal Manure         |        |
|-----------|-----------|---------------------|--------|-----------------------|--------|
|           |           | Nitrogen<br>(kg/yr) | (T/yr) | Phosphorus<br>(kg/yr) | (T/yr) |
| Butler    | 20015     | 5,693,000           | 6,277  | 1,836,800             | 2,025  |
| Chase     | 20017     | 2,308,000           | 2,545  | 706,800               | 779    |
| Cowley    | 20035     | 3,351,900           | 3,695  | 1,099,100             | 1,212  |
| Elk       | 20049     | 1,732,900           | 1,911  | 515,300               | 568    |
| Greenwood | 20073     | 3,169,400           | 3,494  | 920,700               | 1,015  |
| Harvey    | 20079     | 1,988,600           | 2,192  | 666,100               | 734    |
| Marion    | 20115     | 3,867,100           | 4,263  | 1,231,400             | 1,358  |
| Sedgwick  | 20173     | 2,255,800           | 2,487  | 612,900               | 676    |
| Sumner    | 20191     | 2,127,300           | 2,345  | 638,800               | 704    |

1992 data from Puckett et al. (1998).

**Table 10.** Estimates of commercial fertilizers sold by county included in the Walnut River/Grouse Creek Watershed.

| County    | FIPS Code | County Area<br>(ha) | Nitrogen   |        | Phosphorus |        |
|-----------|-----------|---------------------|------------|--------|------------|--------|
|           |           |                     | (kg/yr)    | (T/yr) | (kg/yr)    | (T/yr) |
| Butler    | 20015     | 374,761             | 7,570,456  | 8,347  | 867,495    | 956    |
| Chase     | 20017     | 201,386             | 957,987    | 1,056  | 109,674    | 121    |
| Cowley    | 20035     | 293,323             | 5,379,605  | 5,931  | 616,472    | 680    |
| Elk       | 20049     | 168,544             | 1,011,511  | 1,115  | 116,009    | 128    |
| Greenwood | 20073     | 298,700             | 2,230,767  | 2,459  | 255,774    | 282    |
| Harvey    | 20079     | 140,054             | 7,514,211  | 8,284  | 861,160    | 949    |
| Marion    | 20115     | 247,042             | 9,578,056  | 10,560 | 1,097,534  | 1,210  |
| Sedgwick  | 20173     | 261,207             | 11,548,461 | 12,732 | 1,323,217  | 1,459  |
| Sumner    | 20191     | 306,844             | 12,807,634 | 14,120 | 1,467,733  | 1,618  |

1991 data from Battaglin and Goolsby (1994).

**Table 11.** SWAT hydrologic calibration results at USGS gaging stations with unregulated flow in the Walnut River/Grouse Creek Watershed.

| USGS Gage | Comparison Period Of Record | Compared Flow | Measured Annual Mean *(cms) | SWAT Annual Mean *(cms) | Annual Correlation ( $r^2$ ) | Relative Annual Difference (%) |
|-----------|-----------------------------|---------------|-----------------------------|-------------------------|------------------------------|--------------------------------|
| 07147070  | 1962 – 2000                 | Total Flow    | 5.77                        | 5.72                    | 0.94                         | -0.93                          |
|           |                             | Base Flow     | 1.00                        | 0.98                    | 0.86                         | -1.92                          |
|           |                             | Surface Flow  | 4.78                        | 4.77                    | 0.93                         | -0.12                          |
| 07146570  | 1962 – 1979                 | Total Flow    | 0.45                        | 0.43                    | 0.86                         | -6.23                          |
|           |                             | Base Flow     | 0.05                        | 0.05                    | 0.62                         | 0.00                           |
|           |                             | Surface Flow  | 0.41                        | 0.39                    | 0.88                         | -4.96                          |
| 07147800  | 1948 – 2000                 | Total Flow    | 26.73                       | 26.05                   | 0.96                         | -2.56                          |
|           |                             | Base Flow     | 6.53                        | 6.46                    | 0.88                         | -1.10                          |
|           |                             | Surface Flow  | 20.20                       | 20.96                   | 0.88                         | 3.80                           |

\*1 cms = 35.31 cfs

**Table 12.** Comparisons of measured and simulated mean annual discharge at USGS gaging stations with limited records or regulated flows.

| USGS Gage ID     | Comparison Period Of Record | Measured Annual Mean *(cms) | SWAT Annual Mean *(cms) | Annual Correlation ( $r^2$ ) | Relative Annual Difference (%) |
|------------------|-----------------------------|-----------------------------|-------------------------|------------------------------|--------------------------------|
| 07147050         | 1968                        | 1.34                        | 1.31                    | ---                          | -2.32                          |
| 07146990         | 1968                        | 2.65                        | 2.61                    | ---                          | -1.48                          |
| 07147060         | 1968                        | 2.61                        | 2.74                    | ---                          | 5.03                           |
| 07147100         | 1952 - 1954                 | 1.55                        | 1.73                    | 0.77                         | 11.88                          |
| 07146830         | 1982 - 1997                 | 4.56                        | 4.25                    | 0.94                         | -6.61                          |
| El Dorado Inflow | 1994 - 2000                 | 4.64                        | 4.36                    | 0.95                         | -6.11                          |

\*1 cms = 35.31 cfs

**Table 13.** Summaries of measured water quality parameters at KDHE TMDL and USGS gage sites, and model estimated concentrations.

| Variable                        | Site ID  | POR                         | N   | Mean   | St. Dev. | SWAT<br>(Corresponding<br>POR) | SWAT<br>(‘48-‘00) |
|---------------------------------|----------|-----------------------------|-----|--------|----------|--------------------------------|-------------------|
| Ammonia<br>(mg/l as N)          | SC038    | '85-'02                     | 120 | 0.11   | 0.20     | 0.54                           | 0.67              |
|                                 | SC279    | '85-'02                     | 122 | 0.15   | 0.26     | 0.15                           | 0.20              |
|                                 | SC106    | '85-'02                     | 122 | 0.06   | 0.09     | 0.31                           | 0.39              |
|                                 | SC704    | '95, '99                    | 12  | 0.10   | 0.13     | 0.23                           | 0.34              |
|                                 | SC655    | '91, '95, '99               | 17  | 0.03   | 0.04     | 0.14                           | 0.18              |
|                                 | SC654    | '91, '95, '99               | 18  | 0.05   | 0.08     | 0.14                           | 0.18              |
|                                 | SC653    | '91, '95, '99               | 17  | 0.09   | 0.11     | 0.13                           | 0.19              |
|                                 | SC532    | '85-'02                     | 71  | 0.07   | 0.08     | 0.31                           | 0.39              |
| Nitrate<br>(mg/l as N)          | 07146570 | '62-'64, +                  | 26  | 0.53   | 0.67     | 0.54                           | 0.82              |
|                                 | SC038    | '85-'02                     | 117 | 1.71   | 1.07     | 1.06                           | 1.93              |
|                                 | 07147070 | '61-'75                     | 219 | 0.88   | 0.59     | 1.54                           | 1.93              |
|                                 | 07147100 | '62-'64                     | 40  | 0.51   | 0.47     | 1.53                           | 1.85              |
|                                 | SC279    | '85-'02                     | 119 | 0.95   | 0.47     | 0.39                           | 0.70              |
|                                 | SC106    | '85-'02                     | 119 | 0.79   | 0.57     | 0.89                           | 1.37              |
|                                 | SC704    | '95, '99                    | 12  | 0.79   | 0.37     | 0.89                           | 1.15              |
|                                 | SC655    | '91, '95, '99               | 17  | 0.24   | 0.20     | 0.38                           | 0.54              |
|                                 | SC654    | '91, '94, '99               | 18  | 0.44   | 0.47     | 0.67                           | 0.56              |
|                                 | SC653    | '91, '95, '99               | 17  | 0.46   | 0.36     | 0.35                           | 0.49              |
|                                 | 07157800 | '59-'75                     | 241 | 0.66   | 0.47     | 1.05                           | 1.16              |
|                                 | SC532    | '90-'02                     | 68  | 0.63   | 0.56     | 0.79                           | 1.15              |
| Total Phosphorus<br>(mg/l as P) | 07146570 | '62-'63, +                  | 20  | 0.07   | 0.04     | 0.37                           | 0.46              |
|                                 | SC038    | '85-'02                     | 120 | 0.29   | 0.34     | 0.70                           | 0.72              |
|                                 | 07147070 | '62, '66-'78                | 134 | 0.21   | 0.26     | 0.69                           | 0.72              |
|                                 | 07147100 | '62-'63                     | 21  | 0.14   | 0.09     | 0.61                           | 0.68              |
|                                 | SC279    | '85-'02                     | 122 | 0.45   | 0.30     | 0.16                           | 0.20              |
|                                 | SC106    | '85-'02                     | 122 | 0.31   | 0.20     | 0.39                           | 0.41              |
|                                 | SC704    | '95, '99                    | 12  | 0.30   | 0.18     | 0.37                           | 0.36              |
|                                 | SC655    | '91, '95, '99               | 16  | 0.14   | 0.10     | 0.18                           | 0.20              |
|                                 | SC654    | '91, '95, '99               | 18  | 0.11   | 0.06     | 0.24                           | 0.27              |
|                                 | SC653    | '91, '95, '99               | 17  | 0.13   | 0.09     | 0.34                           | 0.33              |
|                                 | 07157800 | '65-'75                     | 121 | 0.12   | 0.04     | 0.31                           | 0.34              |
|                                 | SC532    | '90-'02                     | 71  | 0.23   | 0.13     | 0.30                           | 0.33              |
| Total Susp. Sed.<br>(mg/l)      | 07146570 | '62-'64, +                  | 21  | 207    | 170      | 89                             | 99                |
|                                 | SC038    | '85-'02                     | 118 | 126    | 357      | 110                            | 92                |
|                                 | 07147070 | '61-'68, '76-'87            | 173 | 230    | 311      | 94                             | 92                |
|                                 | SC279    | '85-'02                     | 120 | 35     | 46       | 76                             | 59                |
|                                 | SC106    | '85-'02                     | 120 | 80     | 151      | 109                            | 87                |
|                                 | SC704    | '95, '99                    | 12  | 66     | 97       | 148                            | 81                |
|                                 | SC655    | '91, '95, '99               | 17  | 73     | 100      | 35                             | 32                |
|                                 | SC654    | '91, '95, '99               | 18  | 47     | 41       | 27                             | 27                |
|                                 | SC653    | '91, '95, '99               | 17  | 43     | 46       | 51                             | 38                |
|                                 | 07157800 | +,'75-'77, '79-'85, '00-'01 | 123 | 193    | 323      | 88                             | 84                |
|                                 | SC532    | '90-'02                     | 72  | 77     | 97       | 105                            | 84                |
|                                 | SC038    | '87-'01                     | 88  | 3,231  | 11,909   | 4,564                          | 3,350             |
| FCB<br>(col/100 ml)             | 07147070 | '77                         | 11  | 39,029 | 41,768   | 2,075                          | 3,350             |
|                                 | SC279    | '86-'01                     | 91  | 1,128  | 2,783    | 1,323                          | 1,134             |
|                                 | SC106    | '86-'01                     | 89  | 2,718  | 9,059    | 7,593                          | 5,661             |
|                                 | SC704    | '95, '99                    | 9   | 1,316  | 2,228    | 11,526                         | 4,609             |
|                                 | SC655    | '91, '95, '99               | 12  | 1,028  | 1,886    | 946                            | 741               |
|                                 | SC654    | '91, '95, '99               | 12  | 518    | 667      | 486                            | 297               |
|                                 | SC653    | '91, '95, '99               | 13  | 3,859  | 10,493   | 1,062                          | 664               |
|                                 | SC532    | '90-'01                     | 61  | 511    | 813      | 10,730                         | 8,591             |

**Table 14.** Estimated average annual sediment and nutrient yields by 14-digit HUC in the Walnut River/Grouse Creek watershed.

| SWAT Subbasin # | 14-Digit HUC   | Area<br><sup>1</sup> (ha) | Sediment Yield<br><sup>2</sup> t/ha | Organic Nitrogen<br>(as N)<br><sup>3</sup> kg/ha | Organic Phosphorus<br>(as P)<br><sup>3</sup> kg/ha | Nitrate<br>(as N)<br><sup>3</sup> kg/ha | Soluble Phosphorus<br>(as P)<br><sup>3</sup> kg/ha | Sediment-Bound Phosphorus<br>(as P)<br><sup>3</sup> kg/ha |
|-----------------|----------------|---------------------------|-------------------------------------|--|--|---|--|---|
| 1               | 11030017010010 | 14,720                    | 1.05                                | 3.11   | 0.64   | 1.23                                    | 0.05   | 0.41  |
| 4, 14           | 11030017010020 | 9,950                     | 1.06                                | 3.49   | 0.75   | 1.22                                    | 0.06   | 0.48  |
| 5               | 11030017010030 | 9,980                     | 1.70                                | 4.30   | 0.90   | 1.25                                    | 0.05   | 0.56  |
| 10, 11          | 11030017010040 | 14,440                    | 1.57                                | 4.35   | 0.93   | 1.64                                    | 0.07   | 0.57  |
| 2               | 11030017020010 | 9,090                     | 1.35                                | 4.48   | 0.98   | 1.85                                    | 0.10   | 0.67  |
| 3               | 11030017020020 | 13,480                    | 0.86                                | 3.18   | 0.65   | 1.67                                    | 0.07   | 0.37  |
| 6               | 11030017020030 | 12,960                    | 1.20                                | 4.02   | 0.88   | 1.61                                    | 0.09   | 0.63  |
| 7, 8            | 11030017020040 | 7,090                     | 1.74                                | 5.05   | 1.13   | 1.68                                    | 0.10   | 0.85  |
| 9               | 11030017020050 | 8,780                     | 1.32                                | 3.66   | 0.82   | 1.60                                    | 0.08   | 0.59  |
| 12              | 11030017020060 | 10,900                    | 0.95                                | 2.73   | 0.60   | 1.11                                    | 0.06   | 0.44  |
| 13, 16          | 11030017020070 | 12,460                    | 0.87                                | 2.27   | 0.50   | 1.18                                    | 0.06   | 0.38  |
| 19              | 11030017020080 | 12,020                    | 0.88                                | 2.58   | 0.54   | 1.28                                    | 0.07   | 0.41  |
| 29              | 11030017030010 | 15,880                    | 0.40                                | 1.29   | 0.33   | 1.27                                    | 0.04   | 0.13  |
| 30              | 11030017030020 | 7,910                     | 0.51                                | 1.54   | 0.32   | 1.58                                    | 0.05   | 0.22  |
| 28              | 11030017030030 | 9,960                     | 0.34                                | 1.01   | 0.22   | 1.43                                    | 0.04   | 0.14  |
| 27              | 11030017030040 | 8,270                     | 0.29                                | 0.90   | 0.18   | 1.51                                    | 0.05   | 0.11  |
| 26              | 11030017030050 | 11,400                    | 0.45                                | 1.24   | 0.27   | 1.56                                    | 0.06   | 0.16  |
| 24              | 11030017030060 | 10,020                    | 0.18                                | 0.60   | 0.11   | 1.24                                    | 0.05   | 0.10  |
| 23              | 11030017030070 | 7,020                     | 0.76                                | 1.90   | 0.43   | 1.53                                    | 0.05   | 0.28  |
| 25              | 11030017040010 | 10,750                    | 0.55                                | 1.73   | 0.35   | 1.47                                    | 0.05   | 0.25  |
| 22              | 11030017040020 | 9,580                     | 0.17                                | 0.57   | 0.10   | 1.29                                    | 0.05   | 0.08  |
| 21              | 11030017040030 | 11,420                    | 0.33                                | 1.07   | 0.21   | 1.18                                    | 0.04   | 0.16  |
| 17, 18          | 11030017040040 | 15,370                    | 0.58                                | 1.62   | 0.35   | 1.12                                    | 0.04   | 0.25  |
| 15              | 11030018010010 | 9,760                     | 0.61                                | 1.70   | 0.34   | 1.40                                    | 0.06   | 0.23  |
| 20              | 11030018010020 | 9,200                     | 0.70                                | 2.00   | 0.43   | 1.09                                    | 0.06   | 0.31  |
| 37              | 11030018010030 | 7,050                     | 0.84                                | 2.26   | 0.49   | 0.89                                    | 0.04   | 0.36  |
| 31              | 11030018010040 | 14,940                    | 0.31                                | 0.96   | 0.19   | 1.32                                    | 0.06   | 0.13  |
| 32              | 11030018010050 | 10,320                    | 0.41                                | 1.17   | 0.28   | 1.46                                    | 0.06   | 0.12  |
| 34              | 11030018010060 | 12,160                    | 0.44                                | 1.32   | 0.28   | 1.05                                    | 0.04   | 0.17  |
| 33              | 11030018010070 | 13,210                    | 0.30                                | 0.86   | 0.20   | 1.17                                    | 0.04   | 0.09  |
| 35              | 11030018010080 | 13,120                    | 0.35                                | 1.01   | 0.21   | 1.09                                    | 0.03   | 0.12  |
| 36              | 11030018010090 | 6,460                     | 0.62                                | 1.91   | 0.40   | 0.87                                    | 0.04   | 0.27  |
| 40              | 11030018020010 | 12,110                    | 0.81                                | 1.98   | 0.54   | 1.13                                    | 0.04   | 0.21  |
| 41              | 11030018020020 | 11,110                    | 1.33                                | 3.49   | 0.96   | 1.03                                    | 0.05   | 0.34  |
| 42              | 11030018020030 | 12,720                    | 1.66                                | 4.16   | 1.13   | 1.19                                    | 0.05   | 0.40  |
| 38              | 11030018020040 | 10,970                    | 0.22                                | 0.65   | 0.15   | 1.16                                    | 0.04   | 0.06  |
| 39              | 11030018020050 | 11,920                    | 0.32                                | 0.89   | 0.23   | 1.10                                    | 0.03   | 0.09  |
| 43              | 11030018020060 | 11,890                    | 0.62                                | 1.73   | 0.46   | 0.91                                    | 0.03   | 0.17  |
| 44              | 11030018020070 | 7,370                     | 0.84                                | 1.91   | 0.63   | 0.48                                    | 0.02   | 0.20  |
| 45              | 11030018030010 | 9,150                     | 0.63                                | 1.48   | 0.38   | 0.80                                    | 0.04   | 0.23  |
| 46              | 11030018030020 | 9,560                     | 0.46                                | 1.12   | 0.31   | 1.21                                    | 0.04   | 0.14  |
| 47, 48          | 11030018030030 | 8,130                     | 0.40                                | 1.00   | 0.23   | 1.08                                    | 0.03   | 0.14  |
| 49              | 11030018030040 | 13,590                    | 0.65                                | 1.71   | 0.47   | 1.03                                    | 0.03   | 0.16  |
| 50              | 11030018030050 | 10,240                    | 0.68                                | 1.60   | 0.39   | 1.05                                    | 0.04   | 0.24  |
| 51              | 11030018030060 | 10,010                    | 0.48                                | 1.13   | 0.29   | 0.56                                    | 0.03   | 0.19  |
| 59              | 11030018030070 | 12,810                    | 0.79                                | 1.80   | 0.42   | 0.98                                    | 0.04   | 0.26  |
| 60              | 11030018030080 | 7,590                     | 0.70                                | 1.56   | 0.40   | 0.67                                    | 0.03   | 0.26  |
| 63, 64          | 11030018030090 | 9,560                     | 0.67                                | 1.48   | 0.34   | 0.65                                    | 0.03   | 0.24  |
| 58              | 11060001010010 | 13,520                    | 0.62                                | 1.56   | 0.36   | 1.23                                    | 0.04   | 0.23  |
| 61              | 11060001010020 | 9,390                     | 0.80                                | 1.70   | 0.38   | 1.00                                    | 0.03   | 0.25  |
| 52              | 11060001020010 | 12,660                    | 0.06                                | 0.31   | 0.04   | 1.43                                    | 0.06   | 0.04  |
| 53              | 11060001020020 | 10,560                    | 0.12                                | 0.48   | 0.09   | 1.29                                    | 0.05   | 0.05  |
| 54              | 11060001020030 | 12,580                    | 0.11                                | 0.55   | 0.09   | 1.30                                    | 0.06   | 0.07  |
| 55              | 11060001020040 | 11,830                    | 0.45                                | 1.23   | 0.25   | 0.96                                    | 0.04   | 0.15  |
| 56              | 11060001020050 | 9,480                     | 0.50                                | 1.23   | 0.26   | 0.95                                    | 0.04   | 0.15  |
| 57              | 11060001020060 | 11,190                    | 0.35                                | 1.04   | 0.20   | 0.87                                    | 0.03   | 0.11  |
| 62              | 11060001020070 | 7,570                     | 0.53                                | 1.26   | 0.25   | 0.71                                    | 0.02   | 0.14  |
| 65              | 11060001020080 | 7,600                     | 0.55                                | 1.12   | 0.24   | 0.75                                    | 0.02   | 0.15  |

<sup>1</sup>1 ha = 2.47 ac. <sup>2</sup>1 t/ha = 0.446 T/ac, <sup>3</sup>1 kg/ha = 0.89 lb/ac

**Table 15. Estimated average annual sediment, nutrient, and FCB export by land use for each 14-digit subbasin in the Walnut/Grouse Creek Watershed.**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff (mm) | Sed. Yield <sup>2</sup> (t/ha) <sup>3</sup> | Organic N (kg/ha) <sup>3</sup> | Organic P (kg/ha) <sup>3</sup> | Bound P (kg/ha) <sup>3</sup> | Sed. |       | Soluble P (kg/ha) <sup>3</sup> | FCB (ct/100ml) |
|----------------|----------------------------------|------------------------|--------|---------------------|---|--------------------------------|--------------------------------|------------------------------|------|-------|--------------------------------|----------------|
|                |                                  |                        |        |                     |   |                                |                                |                              | Sed. | Bound |                                |                |
| 11030017010010 | Cropland, Close Grown            | 3,130                  | 21.29  | 172                 | 0.64  | 2.33                           | 0.49                           | 0.28                         | 0.98 | 0.03  | 275                            |                |
|                | Cropland, Generic                | 900                    | 6.10   | 148                 | 3.50  | 8.36                           | 2.33                           | 0.82                         | 1.02 | 0.01  | 300                            |                |
|                | Cropland, Row Crops              | 3,030                  | 20.61  | 151                 | 3.30  | 9.79                           | 1.87                           | 1.38                         | 1.28 | 0.03  | 235                            |                |
|                | Forest, Mixed                    | 210                    | 1.40   | 24                  | 0.00  | 0.01                           | 0.00                           | 0.00                         | 0.09 | 0.00  | 1                              |                |
|                | Pasture, Managed                 | 2,790                  | 18.93  | 62                  | 0.02  | 0.12                           | 0.02                           | 0.06                         | 2.32 | 0.14  | 65                             |                |
|                | Rangeland                        | 4,660                  | 31.68  | 122                 | 0.04  | 0.19                           | 0.03                           | 0.02                         | 0.79 | 0.02  | 59                             |                |
|                | Total Area and Subbasin Averages | 14,720                 | 100.00 | 127                 | 1.05  | 3.11                           | 0.64                           | 0.41                         | 1.23 | 0.05  | 156                            |                |
| 11030017010020 | Cropland, Close Grown            | 1,960                  | 19.70  | 173                 | 0.56  | 2.33                           | 0.51                           | 0.28                         | 1.09 | 0.04  | 396                            |                |
|                | Cropland, Generic                | 680                    | 6.84   | 150                 | 3.94  | 9.86                           | 2.88                           | 0.96                         | 1.14 | 0.01  | 462                            |                |
|                | Cropland, Row Crops              | 2,310                  | 23.25  | 143                 | 2.86  | 9.78                           | 1.92                           | 1.49                         | 1.34 | 0.05  | 352                            |                |
|                | Forest, Mixed                    | 190                    | 1.93   | 19                  | 0.00  | 0.01                           | 0.00                           | 0.00                         | 0.07 | 0.00  | 1                              |                |
|                | Pasture, Managed                 | 2,090                  | 20.96  | 49                  | 0.02  | 0.09                           | 0.02                           | 0.05                         | 1.75 | 0.15  | 60                             |                |
|                | Rangeland                        | 2,720                  | 27.32  | 125                 | 0.04  | 0.22                           | 0.03                           | 0.02                         | 0.90 | 0.03  | 53                             |                |
|                | Total Area and Subbasin Averages | 9,950                  | 100.00 | 122                 | 1.06  | 3.49                           | 0.75                           | 0.48                         | 1.22 | 0.06  | 218                            |                |
| 11030017010030 | Cropland, Close Grown            | 1,570                  | 15.73  | 199                 | 0.89  | 3.03                           | 0.67                           | 0.34                         | 1.07 | 0.02  | 142                            |                |
|                | Cropland, Generic                | 520                    | 5.16   | 166                 | 5.02  | 10.70                          | 2.80                           | 1.07                         | 1.08 | 0.01  | 306                            |                |
|                | Cropland, Row Crops              | 2,530                  | 25.38  | 186                 | 5.03  | 12.43                          | 2.50                           | 1.69                         | 1.39 | 0.03  | 277                            |                |
|                | Forest, Mixed                    | 180                    | 1.84   | 25                  | 0.01  | 0.01                           | 0.00                           | 0.00                         | 0.09 | 0.00  | 1                              |                |
|                | Pasture, Managed                 | 1,940                  | 19.47  | 71                  | 0.03  | 0.18                           | 0.03                           | 0.08                         | 2.12 | 0.15  | 17                             |                |
|                | Rangeland                        | 3,240                  | 32.41  | 141                 | 0.05  | 0.24                           | 0.03                           | 0.02                         | 0.81 | 0.02  | 62                             |                |
|                | Total Area and Subbasin Averages | 9,980                  | 100.00 | 147                 | 1.70  | 4.30                           | 0.90                           | 0.56                         | 1.25 | 0.05  | 132                            |                |
| 11030017010040 | Cropland, Close Grown            | 2,710                  | 18.77  | 213                 | 1.01  | 3.91                           | 0.87                           | 0.43                         | 1.23 | 0.03  | 233                            |                |
|                | Cropland, Generic                | 660                    | 4.54   | 194                 | 6.15  | 14.33                          | 3.96                           | 1.22                         | 1.36 | 0.01  | 720                            |                |
|                | Cropland, Row Crops              | 2,620                  | 18.15  | 182                 | 5.90  | 15.26                          | 3.05                           | 2.18                         | 1.45 | 0.05  | 400                            |                |
|                | Forest, Mixed                    | 360                    | 2.47   | 18                  | 0.00  | 0.01                           | 0.00                           | 0.00                         | 0.06 | 0.00  | 1                              |                |
|                | Pasture, Managed                 | 2,610                  | 18.09  | 97                  | 0.05  | 0.27                           | 0.05                           | 0.13                         | 3.78 | 0.23  | 101                            |                |
|                | Rangeland, Brushy                | 30                     | 0.20   | 77                  | 0.04  | 0.21                           | 0.03                           | 0.02                         | 0.49 | 0.03  | 28                             |                |
|                | Rangeland                        | 5,460                  | 37.78  | 160                 | 0.07  | 0.38                           | 0.05                           | 0.03                         | 1.04 | 0.04  | 60                             |                |
| 11030017020010 | Total Area and Subbasin Averages | 14,450                 | 100.00 | 161                 | 1.57  | 4.35                           | 0.93                           | 0.57                         | 1.64 | 0.07  | 190                            |                |
|                | Cropland, Close Grown            | 1,610                  | 17.65  | 221                 | 0.62  | 2.46                           | 0.59                           | 0.30                         | 1.37 | 0.05  | 366                            |                |
|                | Cropland, Generic                | 660                    | 7.23   | 182                 | 3.86  | 12.79                          | 3.43                           | 0.99                         | 1.31 | 0.01  | 758                            |                |
|                | Cropland, Row Crops              | 2,870                  | 31.52  | 189                 | 3.01  | 9.68                           | 1.94                           | 1.67                         | 1.82 | 0.08  | 566                            |                |
|                | Pasture, Managed                 | 2,230                  | 24.57  | 71                  | 0.02  | 0.11                           | 0.02                           | 0.06                         | 2.79 | 0.23  | 34                             |                |
|                | Rangeland                        | 1,730                  | 19.03  | 161                 | 0.04  | 0.25                           | 0.04                           | 0.02                         | 1.34 | 0.05  | 53                             |                |
|                | Total Area and Subbasin Averages | 9,090                  | 100.00 | 160                 | 1.35  | 4.48                           | 0.98                           | 0.67                         | 1.85 | 0.10  | 316                            |                |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff | Sed. Yield          | Organic N            | Organic P            | Bound P              | Sed. Nitrate         | Soluble P  | FCB   |
|----------------|----------------------------------|------------------------|--------|----------------|---------------------|----------------------|----------------------|----------------------|----------------------|------------|-------|
|                |                                  |                        |        | (mm)           | <sup>2</sup> (t/ha) | <sup>3</sup> (kg/ha) | <sup>3</sup> (kg/ha) | <sup>3</sup> (kg/ha) | <sup>3</sup> (kg/ha) | (ct/100ml) |       |
| 11030017020020 | Cropland, Close Grown            | 2,560                  | 18.96  | 223            | 0.53                | 2.14                 | 0.47                 | 0.23                 | 1.29                 | 0.04       | 283   |
|                | Cropland, Generic                | 710                    | 5.30   | 189            | 4.11                | 12.64                | 3.15                 | 0.95                 | 1.23                 | 0.01       | 414   |
|                | Cropland, Row Crops              | 3,010                  | 22.32  | 191            | 2.35                | 9.05                 | 1.70                 | 1.16                 | 1.78                 | 0.05       | 325   |
|                | Forest, Mixed                    | 280                    | 2.09   | 18             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.07                 | 0.00       | 1     |
|                | Pasture, Managed                 | 2,480                  | 18.42  | 62             | 0.01                | 0.08                 | 0.01                 | 0.04                 | 2.90                 | 0.18       | 56    |
|                | Rangeland                        | 4,440                  | 32.90  | 156            | 0.04                | 0.19                 | 0.03                 | 0.02                 | 1.31                 | 0.04       | 60    |
|                | Total Area and Subbasin Averages | 13,490                 | 100.00 | 158            | 0.86                | 3.17                 | 0.65                 | 0.37                 | 1.67                 | 0.07       | 178   |
| 11030017020030 | Cropland, Close Grown            | 1,930                  | 14.86  | 215            | 0.70                | 2.89                 | 0.66                 | 0.37                 | 1.39                 | 0.06       | 355   |
|                | Cropland, Generic                | 750                    | 5.79   | 175            | 4.76                | 14.09                | 3.93                 | 1.15                 | 1.27                 | 0.02       | 756   |
|                | Cropland, Row Crops              | 3,300                  | 25.43  | 170            | 3.16                | 10.53                | 2.11                 | 1.91                 | 1.67                 | 0.08       | 599   |
|                | Forest, Mixed                    | 300                    | 2.35   | 19             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.07                 | 0.00       | 1     |
|                | Pasture, Managed                 | 2,750                  | 21.23  | 58             | 0.01                | 0.10                 | 0.02                 | 0.06                 | 2.39                 | 0.20       | 29    |
|                | Rangeland                        | 3,930                  | 30.35  | 162            | 0.04                | 0.24                 | 0.03                 | 0.02                 | 1.32                 | 0.05       | 43    |
|                | Total Area and Subbasin Averages | 12,960                 | 100.00 | 147            | 1.20                | 4.02                 | 0.88                 | 0.63                 | 1.61                 | 0.09       | 268   |
| 11030017020040 | Cropland, Close Grown            | 1,060                  | 14.90  | 223            | 0.89                | 3.40                 | 0.85                 | 0.46                 | 1.36                 | 0.06       | 424   |
|                | Cropland, Generic                | 380                    | 5.38   | 187            | 5.31                | 13.91                | 3.98                 | 1.32                 | 1.35                 | 0.02       | 1,850 |
|                | Cropland, Row Crops              | 2,010                  | 28.36  | 192            | 4.59                | 13.00                | 2.72                 | 2.42                 | 1.73                 | 0.08       | 689   |
|                | Forest, Mixed                    | 140                    | 2.04   | 24             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.09                 | 0.00       | 1     |
|                | Pasture, Managed                 | 1,650                  | 23.26  | 72             | 0.03                | 0.16                 | 0.03                 | 0.09                 | 2.55                 | 0.23       | 224   |
|                | Rangeland, Brushy                | 0                      | 0.05   | 101            | 0.03                | 0.20                 | 0.03                 | 0.02                 | 0.84                 | 0.04       | 22    |
|                | Rangeland                        | 1,850                  | 26.01  | 163            | 0.05                | 0.29                 | 0.04                 | 0.02                 | 1.22                 | 0.04       | 51    |
| 11030017020050 | Total Area and Subbasin Averages | 7,100                  | 100.00 | 157            | 1.74                | 5.05                 | 1.13                 | 0.85                 | 1.68                 | 0.10       | 424   |
|                | Cropland, Close Grown            | 1,010                  | 11.53  | 228            | 1.02                | 3.92                 | 0.98                 | 0.54                 | 1.42                 | 0.06       | 446   |
|                | Cropland, Generic                | 340                    | 3.85   | 184            | 5.86                | 15.87                | 4.41                 | 1.39                 | 1.34                 | 0.02       | 1,844 |
|                | Cropland, Row Crops              | 1,390                  | 15.78  | 190            | 6.02                | 15.48                | 3.24                 | 2.83                 | 1.66                 | 0.07       | 730   |
|                | Forest, Mixed                    | 190                    | 2.16   | 19             | 0.00                | 0.02                 | 0.00                 | 0.00                 | 0.07                 | 0.00       | 1     |
|                | Pasture, Managed                 | 1,590                  | 18.12  | 79             | 0.03                | 0.19                 | 0.03                 | 0.11                 | 2.86                 | 0.23       | 246   |
|                | Rangeland, Brushy                | 120                    | 1.41   | 101            | 0.04                | 0.29                 | 0.04                 | 0.02                 | 0.78                 | 0.04       | 35    |
| 11030017020060 | Rangeland                        | 4,140                  | 47.15  | 164            | 0.04                | 0.25                 | 0.03                 | 0.02                 | 1.25                 | 0.04       | 44    |
|                | Total Area and Subbasin Averages | 8,780                  | 100.00 | 157            | 1.32                | 3.66                 | 0.82                 | 0.59                 | 1.60                 | 0.08       | 304   |
|                | Cropland, Close Grown            | 450                    | 4.17   | 190            | 0.82                | 3.66                 | 0.84                 | 0.45                 | 1.12                 | 0.05       | 324   |
|                | Cropland, Generic                | 380                    | 3.50   | 158            | 5.13                | 13.63                | 3.90                 | 1.19                 | 1.09                 | 0.01       | 1,647 |
|                | Cropland, Row Crops              | 1,560                  | 14.30  | 167            | 5.00                | 13.73                | 2.86                 | 2.53                 | 1.48                 | 0.07       | 666   |
|                | Forest, Mixed                    | 280                    | 2.56   | 20             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.07                 | 0.00       | 1     |
|                | Pasture, Managed                 | 1,510                  | 13.85  | 48             | 0.02                | 0.12                 | 0.02                 | 0.07                 | 1.54                 | 0.16       | 174   |
|                | Rangeland, Brushy                | 270                    | 2.51   | 95             | 0.04                | 0.27                 | 0.03                 | 0.02                 | 0.67                 | 0.03       | 34    |
|                | Rangeland                        | 6,450                  | 59.11  | 150            | 0.04                | 0.19                 | 0.03                 | 0.02                 | 0.98                 | 0.03       | 35    |
|                | Total Area and Subbasin Averages | 10,900                 | 100.00 | 135            | 0.95                | 2.73                 | 0.60                 | 0.44                 | 1.11                 | 0.05       | 212   |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff |                           |                      |                      | Sed.                 | Organic N            | Organic P            | Bound P              | Soluble Nitrate P    | Soluble P | FCB |
|----------------|----------------------------------|------------------------|--------|----------------|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------|-----|
|                |                                  |                        |        | (mm)           | Yield <sup>2</sup> (t/ha) | (kg/ha) <sup>3</sup> |           |     |
| 11030017020070 | Cropland, Close Grown            | 920                    | 7.36   | 187            | 0.96                      | 3.31                 | 0.79                 | 0.52                 | 1.00                 | 0.05                 | 441                  |                      |           |     |
|                | Cropland, Generic                | 380                    | 3.05   | 166            | 4.65                      | 12.03                | 3.30                 | 1.19                 | 0.98                 | 0.02                 | 1,412                |                      |           |     |
|                | Cropland, Row Crops              | 1,380                  | 11.08  | 168            | 5.56                      | 13.16                | 2.83                 | 2.48                 | 1.33                 | 0.06                 | 529                  |                      |           |     |
|                | Urban/Recreational Grass         | 100                    | 0.76   | 85             | 0.04                      | 0.17                 | 0.03                 | 0.06                 | 1.49                 | 0.10                 | 1                    |                      |           |     |
|                | Forest, Mixed                    | 320                    | 2.55   | 26             | 0.00                      | 0.02                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1                    |                      |           |     |
|                | Pasture, Managed                 | 1,660                  | 13.34  | 57             | 0.03                      | 0.16                 | 0.03                 | 0.09                 | 1.53                 | 0.15                 | 89                   |                      |           |     |
|                | Rangeland, Brushy                | 330                    | 2.65   | 130            | 0.06                      | 0.30                 | 0.04                 | 0.02                 | 0.79                 | 0.03                 | 50                   |                      |           |     |
|                | Rangeland                        | 6,930                  | 55.59  | 167            | 0.05                      | 0.25                 | 0.03                 | 0.02                 | 1.04                 | 0.03                 | 53                   |                      |           |     |
|                | Urban, Com./Ind./Trans.          | 110                    | 0.88   | 404            | 0.46                      | 1.97                 | 0.39                 | 0.22                 | 5.14                 | 0.23                 | 1                    |                      |           |     |
|                | Urban, High Density Resid.       | 80                     | 0.63   | 334            | 0.44                      | 1.53                 | 0.35                 | 0.14                 | 4.00                 | 0.20                 | 1                    |                      |           |     |
|                | Urban, Low Density Resid.        | 260                    | 2.11   | 144            | 0.07                      | 0.25                 | 0.05                 | 0.06                 | 1.88                 | 0.09                 | 1                    |                      |           |     |
|                | Total Area and Subbasin Averages | 12,470                 | 100.00 | 152            | 0.87                      | 2.27                 | 0.50                 | 0.38                 | 1.18                 | 0.06                 | 177                  |                      |           |     |
| 11030017020080 | Cropland, Close Grown            | 1,610                  | 13.37  | 199            | 0.69                      | 2.52                 | 0.56                 | 0.35                 | 0.96                 | 0.04                 | 376                  |                      |           |     |
|                | Cropland, Generic                | 450                    | 3.76   | 183            | 4.31                      | 11.10                | 2.93                 | 1.14                 | 1.01                 | 0.02                 | 397                  |                      |           |     |
|                | Cropland, Row Crops              | 1,970                  | 16.40  | 168            | 3.63                      | 10.30                | 2.06                 | 1.77                 | 1.10                 | 0.06                 | 357                  |                      |           |     |
|                | Urban/Recreational Grass         | 130                    | 1.08   | 108            | 0.04                      | 0.19                 | 0.03                 | 0.06                 | 2.14                 | 0.13                 | 1                    |                      |           |     |
|                | Forest, Mixed                    | 300                    | 2.48   | 24             | 0.00                      | 0.01                 | 0.00                 | 0.00                 | 0.08                 | 0.00                 | 1                    |                      |           |     |
|                | Pasture, Managed                 | 2,110                  | 17.52  | 106            | 0.04                      | 0.19                 | 0.03                 | 0.09                 | 2.64                 | 0.20                 | 153                  |                      |           |     |
|                | Rangeland                        | 5,460                  | 45.38  | 175            | 0.05                      | 0.21                 | 0.03                 | 0.02                 | 0.98                 | 0.03                 | 48                   |                      |           |     |
|                | Total Area and Subbasin Averages | 12,030                 | 100.00 | 161            | 0.88                      | 2.58                 | 0.54                 | 0.41                 | 1.28                 | 0.07                 | 172                  |                      |           |     |
| 11030017030010 | Cropland, Generic                | 290                    | 1.85   | 157            | 3.35                      | 10.48                | 2.82                 | 1.08                 | 1.05                 | 0.02                 | 749                  |                      |           |     |
|                | Cropland, Row Crops              | 1,160                  | 7.27   | 195            | 4.23                      | 12.73                | 3.50                 | 1.24                 | 1.45                 | 0.02                 | 775                  |                      |           |     |
|                | Forest, Mixed                    | 250                    | 1.58   | 14             | 0.00                      | 0.01                 | 0.00                 | 0.00                 | 0.05                 | 0.00                 | 1                    |                      |           |     |
|                | Pasture, Managed                 | 1,420                  | 8.94   | 54             | 0.02                      | 0.11                 | 0.02                 | 0.05                 | 2.14                 | 0.13                 | 83                   |                      |           |     |
|                | Rangeland, Brushy                | 370                    | 2.34   | 156            | 0.06                      | 0.31                 | 0.04                 | 0.02                 | 0.88                 | 0.02                 | 71                   |                      |           |     |
|                | Rangeland                        | 12,400                 | 78.02  | 156            | 0.03                      | 0.19                 | 0.03                 | 0.01                 | 1.20                 | 0.03                 | 25                   |                      |           |     |
|                | Total Area and Subbasin Averages | 15,890                 | 100.00 | 148            | 0.40                      | 1.28                 | 0.33                 | 0.13                 | 1.27                 | 0.04                 | 98                   |                      |           |     |
| 11030017030020 | Cropland, Close Grown            | 190                    | 2.40   | 251            | 1.01                      | 3.60                 | 0.90                 | 0.51                 | 1.56                 | 0.06                 | 458                  |                      |           |     |
|                | Cropland, Generic                | 140                    | 1.82   | 182            | 4.38                      | 12.64                | 3.46                 | 1.11                 | 1.16                 | 0.01                 | 1,639                |                      |           |     |
|                | Cropland, Row Crops              | 550                    | 6.93   | 207            | 5.20                      | 14.51                | 3.02                 | 2.41                 | 1.90                 | 0.07                 | 585                  |                      |           |     |
|                | Forest, Mixed                    | 140                    | 1.79   | 21             | 0.00                      | 0.01                 | 0.00                 | 0.00                 | 0.07                 | 0.00                 | 1                    |                      |           |     |
|                | Pasture, Managed                 | 840                    | 10.66  | 73             | 0.03                      | 0.16                 | 0.03                 | 0.08                 | 3.22                 | 0.18                 | 217                  |                      |           |     |
|                | Rangeland, Brushy                | 90                     | 1.12   | 138            | 0.05                      | 0.28                 | 0.04                 | 0.02                 | 1.04                 | 0.03                 | 41                   |                      |           |     |
|                | Rangeland                        | 5,950                  | 75.29  | 191            | 0.05                      | 0.26                 | 0.04                 | 0.02                 | 1.37                 | 0.03                 | 54                   |                      |           |     |
|                | Total Area and Subbasin Averages | 7,910                  | 100.00 | 177            | 0.51                      | 1.54                 | 0.32                 | 0.22                 | 1.57                 | 0.05                 | 146                  |                      |           |     |
| 11030017030030 | Cropland, Generic                | 170                    | 1.71   | 199            | 3.90                      | 11.30                | 3.09                 | 1.12                 | 1.43                 | 0.02                 | 1,967                |                      |           |     |
|                | Cropland, Row Crops              | 450                    | 4.50   | 220            | 5.15                      | 14.02                | 3.04                 | 2.26                 | 2.16                 | 0.07                 | 613                  |                      |           |     |
|                | Forest, Mixed                    | 110                    | 1.10   | 14             | 0.00                      | 0.01                 | 0.00                 | 0.00                 | 0.05                 | 0.00                 | 1                    |                      |           |     |
|                | Pasture, Managed                 | 830                    | 8.29   | 83             | 0.03                      | 0.20                 | 0.03                 | 0.09                 | 3.71                 | 0.19                 | 183                  |                      |           |     |
|                | Rangeland, Brushy                | 180                    | 1.83   | 138            | 0.05                      | 0.29                 | 0.04                 | 0.02                 | 0.94                 | 0.02                 | 42                   |                      |           |     |
|                | Rangeland                        | 8,220                  | 82.57  | 194            | 0.04                      | 0.20                 | 0.03                 | 0.01                 | 1.19                 | 0.02                 | 43                   |                      |           |     |
|                | Total Area and Subbasin Averages | 9,960                  | 100.00 | 183            | 0.34                      | 1.01                 | 0.22                 | 0.14                 | 1.43                 | 0.04                 | 113                  |                      |           |     |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff (mm) |                                | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha) | Nitrate <sup>3</sup> (kg/ha)   | Soluble P <sup>3</sup> (kg/ha) | FCB |
|----------------|----------------------------------|------------------------|--------|---------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|-----|
|                |                                  |                        |        | Runoff (mm)         | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha)   | Nitrate <sup>3</sup> (kg/ha) | Soluble P <sup>3</sup> (kg/ha) | FCB                            |     |
| 11030017030040 | Cropland, Generic                | 130                    | 1.57   | 208                 | 4.08                           | 11.60                          | 3.08                           | 1.19                           | 1.30                         | 0.02                           | 1,516                          |     |
|                | Cropland, Row Crops              | 240                    | 2.89   | 244                 | 5.59                           | 14.52                          | 3.14                           | 2.32                           | 2.02                         | 0.07                           | 725                            |     |
|                | Pasture, Managed                 | 700                    | 8.41   | 110                 | 0.04                           | 0.27                           | 0.04                           | 0.11                           | 4.10                         | 0.22                           | 202                            |     |
|                | Rangeland, Brushy                | 120                    | 1.51   | 148                 | 0.05                           | 0.29                           | 0.04                           | 0.02                           | 0.94                         | 0.03                           | 49                             |     |
|                | Rangeland                        | 7,080                  | 85.63  | 219                 | 0.07                           | 0.31                           | 0.05                           | 0.02                           | 1.25                         | 0.03                           | 73                             |     |
|                | Total Area and Subbasin Averages | 8,270                  | 100.00 | 209                 | 0.29                           | 0.90                           | 0.18                           | 0.11                           | 1.51                         | 0.05                           | 125                            |     |
| 11030017030050 | Cropland, Generic                | 230                    | 2.00   | 236                 | 6.63                           | 14.77                          | 4.34                           | 1.49                           | 1.57                         | 0.02                           | 1,752                          |     |
|                | Cropland, Row Crops              | 390                    | 3.42   | 247                 | 7.28                           | 17.45                          | 3.86                           | 2.66                           | 2.06                         | 0.07                           | 636                            |     |
|                | Forest, Mixed                    | 230                    | 2.05   | 25                  | 0.00                           | 0.02                           | 0.00                           | 0.00                           | 0.09                         | 0.00                           | 1                              |     |
|                | Pasture, Managed                 | 1,230                  | 10.78  | 104                 | 0.05                           | 0.33                           | 0.06                           | 0.15                           | 3.92                         | 0.24                           | 234                            |     |
|                | Rangeland, Brushy                | 250                    | 2.22   | 156                 | 0.07                           | 0.42                           | 0.06                           | 0.03                           | 1.03                         | 0.03                           | 67                             |     |
|                | Rangeland                        | 9,070                  | 79.53  | 215                 | 0.08                           | 0.38                           | 0.05                           | 0.03                           | 1.27                         | 0.03                           | 83                             |     |
| 11030017030060 | Total Area and Subbasin Averages | 11,400                 | 100.00 | 200                 | 0.45                           | 1.24                           | 0.27                           | 0.16                           | 1.56                         | 0.06                           | 150                            |     |
|                | Cropland, Row Crops              | 310                    | 3.14   | 125                 | 4.45                           | 11.89                          | 2.47                           | 2.18                           | 1.16                         | 0.05                           | 412                            |     |
|                | Pasture, Managed                 | 1,060                  | 10.55  | 75                  | 0.04                           | 0.29                           | 0.05                           | 0.13                           | 3.02                         | 0.20                           | 107                            |     |
|                | Rangeland, Brushy                | 290                    | 2.90   | 127                 | 0.07                           | 0.41                           | 0.05                           | 0.03                           | 0.94                         | 0.03                           | 54                             |     |
|                | Rangeland                        | 8,360                  | 83.41  | 152                 | 0.04                           | 0.22                           | 0.03                           | 0.02                           | 1.02                         | 0.03                           | 41                             |     |
|                | Total Area and Subbasin Averages | 10,030                 | 100.00 | 143                 | 0.18                           | 0.60                           | 0.11                           | 0.10                           | 1.24                         | 0.05                           | 60                             |     |
| 11030017030070 | Cropland, Close Grown            | 110                    | 1.50   | 251                 | 1.20                           | 4.10                           | 1.09                           | 0.56                           | 1.49                         | 0.06                           | 555                            |     |
|                | Cropland, Generic                | 200                    | 2.80   | 205                 | 5.70                           | 13.41                          | 3.88                           | 1.40                           | 1.40                         | 0.02                           | 1,463                          |     |
|                | Cropland, Row Crops              | 530                    | 7.59   | 222                 | 6.97                           | 15.84                          | 3.55                           | 2.56                           | 1.93                         | 0.06                           | 422                            |     |
|                | Urban/Recreational Grass         | 110                    | 1.61   | 67                  | 0.03                           | 0.16                           | 0.03                           | 0.05                           | 1.43                         | 0.09                           | 1                              |     |
|                | Forest, Mixed                    | 150                    | 2.15   | 28                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.10                         | 0.00                           | 1                              |     |
|                | Pasture, Managed                 | 1,020                  | 14.55  | 102                 | 0.05                           | 0.31                           | 0.05                           | 0.13                           | 3.75                         | 0.21                           | 183                            |     |
| 11030017040010 | Rangeland, Brushy                | 310                    | 4.43   | 162                 | 0.08                           | 0.43                           | 0.06                           | 0.03                           | 0.98                         | 0.02                           | 74                             |     |
|                | Rangeland                        | 4,500                  | 64.13  | 199                 | 0.06                           | 0.25                           | 0.04                           | 0.02                           | 1.03                         | 0.02                           | 62                             |     |
|                | Urban, Com./Ind./Trans.          | 90                     | 1.24   | 399                 | 0.39                           | 2.15                           | 0.38                           | 0.14                           | 3.68                         | 0.17                           | 1                              |     |
|                | Total Area and Subbasin Averages | 7,020                  | 100.00 | 182                 | 0.76                           | 1.90                           | 0.43                           | 0.27                           | 1.53                         | 0.05                           | 151                            |     |
|                | Cropland, Close Grown            | 270                    | 2.50   | 220                 | 0.89                           | 3.95                           | 0.86                           | 0.50                           | 1.38                         | 0.06                           | 435                            |     |
|                | Cropland, Generic                | 160                    | 1.45   | 182                 | 4.72                           | 13.54                          | 3.72                           | 1.15                           | 1.19                         | 0.01                           | 1,639                          |     |
|                | Cropland, Row Crops              | 820                    | 7.60   | 197                 | 5.39                           | 15.81                          | 3.21                           | 2.53                           | 1.85                         | 0.07                           | 582                            |     |
|                | Forest, Mixed                    | 170                    | 1.60   | 19                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.07                         | 0.00                           | 1                              |     |
|                | Pasture, Managed                 | 1,000                  | 9.29   | 65                  | 0.03                           | 0.16                           | 0.03                           | 0.08                           | 2.80                         | 0.17                           | 203                            |     |
|                | Rangeland, Brushy                | 140                    | 1.28   | 125                 | 0.05                           | 0.30                           | 0.04                           | 0.02                           | 0.97                         | 0.03                           | 42                             |     |
|                | Rangeland                        | 8,200                  | 76.29  | 182                 | 0.06                           | 0.28                           | 0.04                           | 0.02                           | 1.32                         | 0.03                           | 56                             |     |
|                | Total Area and Subbasin Averages | 10,750                 | 100.00 | 170                 | 0.55                           | 1.73                           | 0.35                           | 0.25                           | 1.47                         | 0.05                           | 141                            |     |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff |                     | Sed.                 | Organic N            | Organic P            | Bound P              | Nitrate P            | Soluble P | FCB |
|----------------|----------------------------------|------------------------|--------|----------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------|-----|
|                |                                  |                        |        | (mm)           | (t/ha) <sup>2</sup> | (kg/ha) <sup>3</sup> |           |     |
| 11030017040020 | Cropland, Close Grown            | 110                    | 1.14   | 164            | 0.70                | 2.84                 | 0.68                 | 0.38                 | 0.90                 | 0.04                 | 425       |     |
|                | Cropland, Row Crops              | 210                    | 2.21   | 177            | 5.21                | 14.21                | 2.83                 | 2.43                 | 1.44                 | 0.07                 | 403       |     |
|                | Urban/Recreational Grass         | 130                    | 1.35   | 83             | 0.04                | 0.18                 | 0.03                 | 0.05                 | 1.63                 | 0.09                 | 1         |     |
|                | Forest, Mixed                    | 160                    | 1.63   | 21             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.08                 | 0.00                 | 1         |     |
|                | Pasture, Managed                 | 1,000                  | 10.47  | 70             | 0.03                | 0.18                 | 0.03                 | 0.09                 | 2.40                 | 0.16                 | 111       |     |
|                | Rangeland, Brushy                | 230                    | 2.44   | 125            | 0.06                | 0.29                 | 0.04                 | 0.02                 | 0.81                 | 0.03                 | 45        |     |
|                | Rangeland                        | 7,340                  | 76.65  | 177            | 0.04                | 0.19                 | 0.03                 | 0.01                 | 1.08                 | 0.03                 | 40        |     |
|                | Urban, Com./Ind./Trans.          | 160                    | 1.65   | 392            | 0.35                | 2.18                 | 0.36                 | 0.18                 | 4.99                 | 0.20                 | 1         |     |
|                | Urban, Low Density Resid.        | 240                    | 2.46   | 147            | 0.07                | 0.24                 | 0.04                 | 0.04                 | 1.52                 | 0.06                 | 1         |     |
|                | Total Area and Subbasin Averages | 9,580                  | 100.00 | 163            | 0.17                | 0.57                 | 0.10                 | 0.08                 | 1.29                 | 0.05                 | 57        |     |
| 11030017040030 | Cropland, Close Grown            | 330                    | 2.88   | 118            | 0.54                | 2.15                 | 0.50                 | 0.27                 | 0.54                 | 0.03                 | 260       |     |
|                | Cropland, Generic                | 160                    | 1.37   | 123            | 3.51                | 11.10                | 2.81                 | 1.04                 | 0.77                 | 0.01                 | 1,068     |     |
|                | Cropland, Row Crops              | 610                    | 5.35   | 131            | 4.05                | 10.94                | 2.17                 | 1.98                 | 0.91                 | 0.05                 | 365       |     |
|                | Urban/Recreational Grass         | 260                    | 2.32   | 92             | 0.04                | 0.23                 | 0.04                 | 0.07                 | 2.05                 | 0.11                 | 1         |     |
|                | Forest, Mixed                    | 190                    | 1.64   | 27             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1         |     |
|                | Pasture, Managed                 | 1,040                  | 9.10   | 64             | 0.03                | 0.19                 | 0.03                 | 0.08                 | 2.07                 | 0.14                 | 100       |     |
|                | Rangeland, Brushy                | 470                    | 4.09   | 130            | 0.07                | 0.36                 | 0.05                 | 0.02                 | 0.77                 | 0.02                 | 62        |     |
|                | Rangeland                        | 7,530                  | 65.94  | 171            | 0.05                | 0.22                 | 0.03                 | 0.01                 | 0.90                 | 0.02                 | 53        |     |
|                | Urban, Com./Ind./Trans.          | 370                    | 3.28   | 394            | 0.25                | 2.02                 | 0.27                 | 0.18                 | 4.65                 | 0.16                 | 1         |     |
|                | Urban, High Density Resid.       | 140                    | 1.23   | 336            | 0.25                | 1.57                 | 0.24                 | 0.11                 | 3.66                 | 0.13                 | 1         |     |
| 11030017040040 | Urban, Low Density Resid.        | 320                    | 2.81   | 146            | 0.07                | 0.23                 | 0.04                 | 0.04                 | 1.55                 | 0.06                 | 1         |     |
|                | Total Area and Subbasin Averages | 11,420                 | 100.00 | 160            | 0.33                | 1.07                 | 0.21                 | 0.16                 | 1.18                 | 0.04                 | 89        |     |
|                | Cropland, Close Grown            | 730                    | 4.74   | 175            | 0.77                | 2.96                 | 0.71                 | 0.40                 | 0.93                 | 0.04                 | 405       |     |
|                | Cropland, Generic                | 400                    | 2.58   | 152            | 3.80                | 11.02                | 2.92                 | 1.11                 | 0.97                 | 0.02                 | 1,080     |     |
|                | Cropland, Row Crops              | 1,230                  | 7.98   | 176            | 5.11                | 12.75                | 2.72                 | 2.21                 | 1.47                 | 0.06                 | 413       |     |
|                | Urban/Recreational Grass         | 10                     | 0.04   | 72             | 0.04                | 0.17                 | 0.03                 | 0.07                 | 1.21                 | 0.10                 | 1         |     |
|                | Forest, Mixed                    | 310                    | 2.02   | 21             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.07                 | 0.00                 | 1         |     |
|                | Pasture, Managed                 | 1,780                  | 11.56  | 73             | 0.03                | 0.20                 | 0.03                 | 0.09                 | 2.41                 | 0.15                 | 111       |     |
|                | Rangeland, Brushy                | 570                    | 3.74   | 125            | 0.06                | 0.31                 | 0.04                 | 0.02                 | 0.73                 | 0.02                 | 54        |     |
|                | Rangeland                        | 10,110                 | 65.82  | 167            | 0.04                | 0.20                 | 0.03                 | 0.01                 | 0.90                 | 0.02                 | 48        |     |
| 11030017040040 | Urban, Com./Ind./Trans.          | 40                     | 0.26   | 404            | 0.65                | 2.17                 | 0.51                 | 0.29                 | 4.58                 | 0.25                 | 1         |     |
|                | Urban, Low Density Resid.        | 190                    | 1.22   | 114            | 0.06                | 0.19                 | 0.04                 | 0.04                 | 1.53                 | 0.07                 | 1         |     |
|                | Wetland, Herbaceous              | 10                     | 0.05   | 179            | 0.09                | 0.39                 | 0.07                 | 0.02                 | 0.60                 | 0.01                 | 1         |     |
|                | Total Area and Subbasin Averages | 15,370                 | 100.00 | 152            | 0.58                | 1.62                 | 0.35                 | 0.25                 | 1.12                 | 0.04                 | 126       |     |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff (mm) |                           | Sed.                 | Organic N            | Organic P            | Bound P              | Soluble Nitrate      | Soluble P            | FCB |
|----------------|----------------------------------|------------------------|--------|---------------------|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----|
|                |                                  |                        |        | Runoff (mm)         | Yield <sup>2</sup> (t/ha) | (kg/ha) <sup>3</sup> |     |
| 11030018010010 | Cropland, Close Grown            | 1,080                  | 11.10  | 201                 | 0.87                      | 3.14                 | 0.64                 | 0.39                 | 1.00                 | 0.03                 | 242                  |     |
|                | Cropland, Generic                | 250                    | 2.51   | 185                 | 4.58                      | 10.49                | 2.64                 | 1.11                 | 1.08                 | 0.02                 | 252                  |     |
|                | Cropland, Row Crops              | 650                    | 6.69   | 181                 | 5.03                      | 11.97                | 2.37                 | 1.82                 | 1.18                 | 0.04                 | 229                  |     |
|                | Urban/Recreational Grass         | 470                    | 4.78   | 111                 | 0.05                      | 0.24                 | 0.04                 | 0.08                 | 2.35                 | 0.13                 | 1                    |     |
|                | Forest, Mixed                    | 220                    | 2.24   | 39                  | 0.01                      | 0.02                 | 0.00                 | 0.00                 | 0.13                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 930                    | 9.52   | 103                 | 0.05                      | 0.25                 | 0.04                 | 0.11                 | 2.86                 | 0.19                 | 55                   |     |
|                | Rangeland, Brushy                | 100                    | 1.07   | 146                 | 0.06                      | 0.29                 | 0.04                 | 0.02                 | 0.87                 | 0.03                 | 41                   |     |
|                | Rangeland                        | 4,910                  | 50.34  | 160                 | 0.06                      | 0.29                 | 0.04                 | 0.02                 | 1.00                 | 0.03                 | 39                   |     |
|                | Urban, Com./Ind./Trans.          | 220                    | 2.21   | 410                 | 0.27                      | 1.99                 | 0.27                 | 0.18                 | 4.08                 | 0.16                 | 1                    |     |
|                | Urban, High Density Resid.       | 160                    | 1.67   | 345                 | 0.30                      | 1.58                 | 0.27                 | 0.13                 | 3.47                 | 0.16                 | 1                    |     |
|                | Urban, Low Density Resid.        | 640                    | 6.59   | 164                 | 0.08                      | 0.25                 | 0.04                 | 0.05                 | 1.54                 | 0.07                 | 1                    |     |
|                | Urban, Medium Density Resid.     | 130                    | 1.30   | 267                 | 0.24                      | 0.67                 | 0.16                 | 0.08                 | 2.87                 | 0.13                 | 1                    |     |
| 11030018010020 | Total Area and Subbasin Averages | 9,760                  | 100.00 | 166                 | 0.61                      | 1.69                 | 0.34                 | 0.23                 | 1.40                 | 0.06                 | 74                   |     |
|                | Cropland, Close Grown            | 520                    | 5.69   | 191                 | 0.92                      | 3.52                 | 0.80                 | 0.52                 | 1.01                 | 0.05                 | 456                  |     |
|                | Cropland, Generic                | 330                    | 3.53   | 151                 | 4.86                      | 13.08                | 3.49                 | 1.23                 | 0.89                 | 0.02                 | 460                  |     |
|                | Cropland, Row Crops              | 860                    | 9.31   | 143                 | 4.78                      | 12.52                | 2.56                 | 2.25                 | 1.11                 | 0.06                 | 370                  |     |
|                | Forest, Mixed                    | 270                    | 2.91   | 22                  | 0.00                      | 0.02                 | 0.00                 | 0.00                 | 0.08                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 1,290                  | 14.02  | 53                  | 0.03                      | 0.16                 | 0.03                 | 0.09                 | 1.31                 | 0.15                 | 54                   |     |
|                | Rangeland, Brushy                | 170                    | 1.80   | 119                 | 0.06                      | 0.36                 | 0.05                 | 0.03                 | 0.83                 | 0.04                 | 50                   |     |
|                | Rangeland                        | 5,570                  | 60.46  | 144                 | 0.04                      | 0.22                 | 0.03                 | 0.02                 | 1.08                 | 0.04                 | 30                   |     |
|                | Urban, Low Density Resid.        | 210                    | 2.29   | 156                 | 0.08                      | 0.30                 | 0.05                 | 0.06                 | 1.70                 | 0.09                 | 1                    |     |
|                | Total Area and Subbasin Averages | 9,210                  | 100.00 | 130                 | 0.70                      | 2.00                 | 0.43                 | 0.31                 | 1.09                 | 0.06                 | 103                  |     |
| 11030018010030 | Cropland, Close Grown            | 620                    | 8.72   | 158                 | 0.71                      | 2.58                 | 0.58                 | 0.38                 | 0.69                 | 0.04                 | 392                  |     |
|                | Cropland, Generic                | 240                    | 3.45   | 161                 | 4.37                      | 10.77                | 3.00                 | 1.01                 | 0.80                 | 0.02                 | 1,448                |     |
|                | Cropland, Row Crops              | 990                    | 14.05  | 156                 | 4.23                      | 11.00                | 2.25                 | 1.96                 | 0.97                 | 0.06                 | 522                  |     |
|                | Forest, Mixed                    | 180                    | 2.51   | 32                  | 0.01                      | 0.02                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 920                    | 13.03  | 57                  | 0.03                      | 0.14                 | 0.02                 | 0.07                 | 1.29                 | 0.12                 | 87                   |     |
|                | Rangeland, Brushy                | 160                    | 2.25   | 142                 | 0.06                      | 0.27                 | 0.03                 | 0.02                 | 0.71                 | 0.02                 | 54                   |     |
|                | Rangeland                        | 3,950                  | 55.98  | 173                 | 0.04                      | 0.16                 | 0.02                 | 0.01                 | 0.85                 | 0.02                 | 41                   |     |
|                | Total Area and Subbasin Averages | 7,050                  | 100.00 | 149                 | 0.83                      | 2.26                 | 0.49                 | 0.36                 | 0.89                 | 0.04                 | 193                  |     |
| 11030018010040 | Cropland, Generic                | 160                    | 1.10   | 150                 | 5.05                      | 13.20                | 3.58                 | 1.24                 | 0.89                 | 0.01                 | 1,307                |     |
|                | Cropland, Row Crops              | 580                    | 3.90   | 149                 | 5.47                      | 14.76                | 3.05                 | 2.26                 | 1.04                 | 0.05                 | 532                  |     |
|                | Forest, Mixed                    | 290                    | 1.97   | 20                  | 0.00                      | 0.02                 | 0.00                 | 0.00                 | 0.07                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 3,060                  | 20.47  | 73                  | 0.02                      | 0.12                 | 0.02                 | 0.06                 | 2.47                 | 0.18                 | 167                  |     |
|                | Rangeland, Brushy                | 520                    | 3.48   | 128                 | 0.06                      | 0.35                 | 0.05                 | 0.02                 | 0.83                 | 0.03                 | 54                   |     |
|                | Rangeland                        | 10,320                 | 69.09  | 177                 | 0.06                      | 0.29                 | 0.04                 | 0.02                 | 1.07                 | 0.03                 | 64                   |     |
|                | Total Area and Subbasin Averages | 14,940                 | 100.00 | 150                 | 0.31                      | 0.96                 | 0.19                 | 0.13                 | 1.32                 | 0.06                 | 115                  |     |
| 11030018010050 | Cropland, Generic                | 160                    | 1.53   | 129                 | 5.81                      | 14.33                | 3.82                 | 1.36                 | 0.73                 | 0.01                 | 646                  |     |
|                | Cropland, Row Crops              | 400                    | 3.92   | 150                 | 6.62                      | 16.51                | 4.45                 | 1.39                 | 0.87                 | 0.02                 | 689                  |     |
|                | Forest, Mixed                    | 230                    | 2.24   | 23                  | 0.01                      | 0.02                 | 0.00                 | 0.00                 | 0.08                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 2,030                  | 19.65  | 97                  | 0.05                      | 0.25                 | 0.04                 | 0.12                 | 3.07                 | 0.21                 | 129                  |     |
|                | Rangeland, Brushy                | 480                    | 4.67   | 129                 | 0.06                      | 0.35                 | 0.05                 | 0.03                 | 0.73                 | 0.03                 | 71                   |     |
|                | Rangeland                        | 7,020                  | 67.99  | 183                 | 0.07                      | 0.35                 | 0.05                 | 0.02                 | 1.14                 | 0.03                 | 78                   |     |
|                | Total Area and Subbasin Averages | 10,320                 | 100.00 | 158                 | 0.41                      | 1.17                 | 0.28                 | 0.12                 | 1.46                 | 0.06                 | 119                  |     |

**Table 15. (Continued)**

| 14-Digit HUC                     | Land Use/Cover                   | Sediment and Soluble Nutrient Loads |        |                     |                                |                                |                                |                              |                                |                                |                |
|----------------------------------|----------------------------------|-------------------------------------|--------|---------------------|--------------------------------|--------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|----------------|
|                                  |                                  | Area <sup>1</sup> (ha)              | % Area | Surface Runoff (mm) | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha) | Nitrate P <sup>3</sup> (kg/ha) | Soluble P <sup>3</sup> (kg/ha) | FCB (ct/100ml) |
| 11030018010060                   | Cropland, Close Grown            | 270                                 | 2.25   | 161                 | 0.73                           | 3.16                           | 0.66                           | 0.40                         | 0.81                           | 0.04                           | 410            |
|                                  | Cropland, Generic                | 280                                 | 2.27   | 142                 | 4.19                           | 11.86                          | 3.11                           | 1.13                         | 0.80                           | 0.02                           | 1,487          |
|                                  | Cropland, Row Crops              | 640                                 | 5.30   | 163                 | 5.36                           | 14.07                          | 2.96                           | 2.21                         | 1.10                           | 0.05                           | 606            |
|                                  | Forest, Mixed                    | 260                                 | 2.17   | 27                  | 0.01                           | 0.02                           | 0.00                           | 0.00                         | 0.09                           | 0.00                           | 1              |
|                                  | Pasture, Managed                 | 1,230                               | 10.13  | 56                  | 0.03                           | 0.15                           | 0.03                           | 0.07                         | 1.40                           | 0.13                           | 112            |
|                                  | Rangeland, Brushy                | 620                                 | 5.07   | 141                 | 0.08                           | 0.41                           | 0.05                           | 0.03                         | 0.88                           | 0.03                           | 69             |
|                                  | Rangeland                        | 8,860                               | 72.81  | 190                 | 0.06                           | 0.27                           | 0.04                           | 0.02                         | 1.05                           | 0.03                           | 61             |
| Total Area and Subbasin Averages |                                  | 12,160                              | 100.00 | 167                 | 0.44                           | 1.32                           | 0.28                           | 0.17                         | 1.05                           | 0.04                           | 135            |
| 11030018010070                   | Cropland, Generic                | 170                                 | 1.29   | 141                 | 6.96                           | 15.82                          | 4.30                           | 1.51                         | 0.80                           | 0.02                           | 524            |
|                                  | Cropland, Row Crops              | 260                                 | 1.98   | 163                 | 7.58                           | 16.07                          | 4.68                           | 1.49                         | 0.95                           | 0.02                           | 530            |
|                                  | Forest, Mixed                    | 360                                 | 2.73   | 24                  | 0.01                           | 0.03                           | 0.00                           | 0.00                         | 0.08                           | 0.00                           | 1              |
|                                  | Pasture, Managed                 | 1,660                               | 12.55  | 84                  | 0.06                           | 0.36                           | 0.06                           | 0.15                         | 2.36                           | 0.17                           | 149            |
|                                  | Rangeland, Brushy                | 570                                 | 4.33   | 116                 | 0.05                           | 0.34                           | 0.05                           | 0.02                         | 0.61                           | 0.02                           | 64             |
|                                  | Rangeland                        | 10,190                              | 77.14  | 170                 | 0.07                           | 0.36                           | 0.05                           | 0.02                         | 1.05                           | 0.03                           | 72             |
|                                  | Total Area and Subbasin Averages | 13,210                              | 100.00 | 152                 | 0.30                           | 0.86                           | 0.20                           | 0.09                         | 1.17                           | 0.04                           | 94             |
| 11030018010080                   | Cropland, Close Grown            | 190                                 | 1.42   | 146                 | 0.97                           | 3.74                           | 0.82                           | 0.52                         | 0.75                           | 0.04                           | 401            |
|                                  | Cropland, Generic                | 190                                 | 1.42   | 140                 | 6.43                           | 16.17                          | 4.01                           | 1.57                         | 0.82                           | 0.02                           | 1,579          |
|                                  | Cropland, Row Crops              | 360                                 | 2.73   | 144                 | 6.74                           | 16.28                          | 3.46                           | 2.48                         | 1.02                           | 0.05                           | 568            |
|                                  | Forest, Mixed                    | 310                                 | 2.33   | 26                  | 0.01                           | 0.03                           | 0.00                           | 0.00                         | 0.09                           | 0.00                           | 1              |
|                                  | Pasture, Managed                 | 900                                 | 6.88   | 37                  | 0.03                           | 0.16                           | 0.03                           | 0.09                         | 0.75                           | 0.11                           | 98             |
|                                  | Rangeland, Brushy                | 410                                 | 3.13   | 131                 | 0.08                           | 0.43                           | 0.06                           | 0.03                         | 0.81                           | 0.02                           | 72             |
|                                  | Rangeland                        | 10,770                              | 82.07  | 200                 | 0.07                           | 0.31                           | 0.05                           | 0.02                         | 1.17                           | 0.02                           | 73             |
| Total Area and Subbasin Averages |                                  | 13,120                              | 100.00 | 179                 | 0.35                           | 1.01                           | 0.21                           | 0.12                         | 1.09                           | 0.03                           | 113            |
| 11030018010090                   | Cropland, Close Grown            | 520                                 | 8.02   | 144                 | 0.68                           | 2.56                           | 0.59                           | 0.36                         | 0.68                           | 0.04                           | 343            |
|                                  | Cropland, Generic                | 260                                 | 3.96   | 157                 | 4.50                           | 12.39                          | 3.22                           | 1.21                         | 0.88                           | 0.02                           | 1,402          |
|                                  | Cropland, Row Crops              | 560                                 | 8.68   | 135                 | 4.07                           | 12.16                          | 2.35                           | 2.03                         | 0.84                           | 0.06                           | 460            |
|                                  | Forest, Mixed                    | 150                                 | 2.25   | 22                  | 0.00                           | 0.01                           | 0.00                           | 0.00                         | 0.07                           | 0.00                           | 1              |
|                                  | Pasture, Managed                 | 770                                 | 11.92  | 39                  | 0.02                           | 0.11                           | 0.02                           | 0.06                         | 0.83                           | 0.10                           | 76             |
|                                  | Rangeland, Brushy                | 190                                 | 2.98   | 104                 | 0.05                           | 0.29                           | 0.04                           | 0.02                         | 0.66                           | 0.04                           | 38             |
|                                  | Rangeland                        | 4,020                               | 62.20  | 154                 | 0.05                           | 0.22                           | 0.03                           | 0.02                         | 0.94                           | 0.03                           | 46             |
| Total Area and Subbasin Averages |                                  | 6,460                               | 100.00 | 134                 | 0.62                           | 1.91                           | 0.40                           | 0.27                         | 0.87                           | 0.04                           | 162            |
| 11030018020010                   | Cropland, Close Grown            | 740                                 | 6.11   | 167                 | 5.38                           | 12.27                          | 3.54                           | 1.31                         | 1.09                           | 0.02                           | 484            |
|                                  | Cropland, Generic                | 330                                 | 2.72   | 150                 | 4.73                           | 10.96                          | 3.11                           | 1.24                         | 0.97                           | 0.02                           | 456            |
|                                  | Cropland, Row Crops              | 730                                 | 5.99   | 176                 | 5.32                           | 12.56                          | 3.54                           | 1.34                         | 1.19                           | 0.02                           | 493            |
|                                  | Forest, Mixed                    | 270                                 | 2.21   | 20                  | 0.00                           | 0.01                           | 0.00                           | 0.00                         | 0.07                           | 0.00                           | 1              |
|                                  | Pasture, Managed                 | 870                                 | 7.15   | 58                  | 0.03                           | 0.15                           | 0.03                           | 0.07                         | 1.63                           | 0.13                           | 49             |
|                                  | Rangeland, Brushy                | 330                                 | 2.71   | 158                 | 0.09                           | 0.41                           | 0.06                           | 0.03                         | 0.80                           | 0.02                           | 100            |
|                                  | Rangeland                        | 8,860                               | 73.11  | 190                 | 0.04                           | 0.21                           | 0.03                           | 0.02                         | 1.13                           | 0.03                           | 49             |
| Total Area and Subbasin Averages |                                  | 12,110                              | 100.00 | 172                 | 0.81                           | 1.98                           | 0.54                           | 0.21                         | 1.13                           | 0.03                           | 114            |

**Table 15. (Continued)**

| 14-Digit HUC                     | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff (mm) |                                | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha) | Nitrate <sup>3</sup> (kg/ha)   | Soluble P <sup>3</sup> (kg/ha) | FCB  |
|----------------------------------|----------------------------------|------------------------|--------|---------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|------|
|                                  |                                  |                        |        | Runoff (mm)         | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha)   | Nitrate <sup>3</sup> (kg/ha) | Soluble P <sup>3</sup> (kg/ha) | FCB                            |      |
| 11030018020020                   | Cropland, Close Grown            | 1,620                  | 14.54  | 138                 | 3.79                           | 9.89                           | 2.83                           | 0.98                           | 0.83                         | 0.01                           | 354                            |      |
|                                  | Cropland, Generic                | 520                    | 4.65   | 171                 | 4.73                           | 13.04                          | 3.42                           | 1.27                           | 1.08                         | 0.02                           | 451                            |      |
|                                  | Cropland, Row Crops              | 1,190                  | 10.70  | 160                 | 5.00                           | 12.47                          | 3.53                           | 1.14                           | 1.00                         | 0.01                           | 437                            |      |
|                                  | Forest, Mixed                    | 340                    | 3.02   | 22                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.08                         | 0.00                           | 1                              |      |
|                                  | Pasture, Managed                 | 1,300                  | 11.72  | 47                  | 0.02                           | 0.12                           | 0.02                           | 0.07                           | 1.31                         | 0.14                           | 40                             |      |
|                                  | Rangeland, Brushy                | 170                    | 1.52   | 129                 | 0.06                           | 0.31                           | 0.04                           | 0.03                           | 0.82                         | 0.04                           | 62                             |      |
|                                  | Rangeland                        | 5,860                  | 52.69  | 144                 | 0.03                           | 0.17                           | 0.02                           | 0.01                           | 1.06                         | 0.05                           | 31                             |      |
|                                  | Urban, Low Density Resid.        | 130                    | 1.16   | 149                 | 0.08                           | 0.27                           | 0.05                           | 0.06                           | 2.03                         | 0.10                           | 1                              |      |
| Total Area and Subbasin Averages |                                  |                        |        | 11,110              | 100.00                         | 131                            | 1.33                           | 3.49                           | 0.96                         | 0.34                           | 1.03                           | 0.05 |
| 11030018020030                   | Cropland, Close Grown            | 3,430                  | 27.01  | 161                 | 3.83                           | 10.01                          | 2.77                           | 0.94                           | 0.98                         | 0.01                           | 308                            |      |
|                                  | Cropland, Generic                | 560                    | 4.42   | 190                 | 6.29                           | 12.91                          | 3.67                           | 1.37                           | 1.21                         | 0.02                           | 392                            |      |
|                                  | Cropland, Row Crops              | 670                    | 5.26   | 182                 | 5.97                           | 13.64                          | 3.75                           | 1.25                           | 1.15                         | 0.01                           | 376                            |      |
|                                  | Forest, Mixed                    | 340                    | 2.70   | 17                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.06                         | 0.00                           | 1                              |      |
|                                  | Pasture, Managed                 | 1,330                  | 10.47  | 77                  | 0.04                           | 0.22                           | 0.04                           | 0.11                           | 2.30                         | 0.20                           | 69                             |      |
|                                  | Rangeland, Brushy                | 250                    | 1.98   | 153                 | 0.08                           | 0.39                           | 0.06                           | 0.03                           | 0.90                         | 0.03                           | 71                             |      |
|                                  | Rangeland                        | 6,120                  | 48.16  | 177                 | 0.06                           | 0.28                           | 0.04                           | 0.02                           | 1.14                         | 0.04                           | 54                             |      |
|                                  | Total Area and Subbasin Averages | 12,720                 | 100.00 | 158                 | 1.66                           | 4.16                           | 1.13                           | 0.40                           | 1.19                         | 0.05                           | 155                            |      |
| 11030018020040                   | Cropland, Generic                | 140                    | 1.30   | 120                 | 5.49                           | 13.78                          | 3.60                           | 1.32                           | 0.73                         | 0.01                           | 704                            |      |
|                                  | Cropland, Row Crops              | 180                    | 1.67   | 157                 | 5.48                           | 12.37                          | 3.54                           | 1.25                           | 1.02                         | 0.02                           | 746                            |      |
|                                  | Forest, Mixed                    | 180                    | 1.61   | 15                  | 0.00                           | 0.02                           | 0.00                           | 0.00                           | 0.05                         | 0.00                           | 1                              |      |
|                                  | Pasture, Managed                 | 1,110                  | 10.14  | 59                  | 0.03                           | 0.16                           | 0.03                           | 0.07                           | 2.11                         | 0.12                           | 84                             |      |
|                                  | Rangeland, Brushy                | 290                    | 2.63   | 112                 | 0.07                           | 0.36                           | 0.05                           | 0.02                           | 0.59                         | 0.02                           | 98                             |      |
|                                  | Rangeland                        | 9,070                  | 82.64  | 169                 | 0.06                           | 0.29                           | 0.04                           | 0.02                           | 1.09                         | 0.03                           | 78                             |      |
|                                  | Total Area and Subbasin Averages | 10,970                 | 100.00 | 153                 | 0.22                           | 0.65                           | 0.15                           | 0.06                           | 1.16                         | 0.04                           | 97                             |      |
|                                  | Cropland, Close Grown            | 350                    | 2.93   | 129                 | 3.68                           | 9.65                           | 2.68                           | 0.96                           | 0.76                         | 0.01                           | 623                            |      |
| 11030018020050                   | Cropland, Generic                | 140                    | 1.21   | 114                 | 3.47                           | 10.14                          | 2.62                           | 0.96                           | 0.65                         | 0.01                           | 634                            |      |
|                                  | Cropland, Row Crops              | 340                    | 2.84   | 156                 | 4.82                           | 11.37                          | 3.32                           | 1.11                           | 0.97                         | 0.02                           | 712                            |      |
|                                  | Forest, Mixed                    | 220                    | 1.86   | 15                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.05                         | 0.00                           | 1                              |      |
|                                  | Pasture, Managed                 | 760                    | 6.38   | 42                  | 0.02                           | 0.11                           | 0.02                           | 0.05                           | 1.27                         | 0.09                           | 73                             |      |
|                                  | Rangeland, Brushy                | 330                    | 2.77   | 111                 | 0.05                           | 0.25                           | 0.03                           | 0.02                           | 0.68                         | 0.02                           | 51                             |      |
|                                  | Rangeland                        | 9,780                  | 82.02  | 162                 | 0.04                           | 0.18                           | 0.02                           | 0.01                           | 1.15                         | 0.03                           | 38                             |      |
|                                  | Total Area and Subbasin Averages | 11,920                 | 100.00 | 148                 | 0.32                           | 0.89                           | 0.23                           | 0.08                           | 1.10                         | 0.03                           | 83                             |      |
|                                  | Cropland, Close Grown            | 1,310                  | 11.03  | 126                 | 3.51                           | 9.45                           | 2.59                           | 0.94                           | 0.74                         | 0.01                           | 485                            |      |
| 11030018020060                   | Cropland, Generic                | 380                    | 3.16   | 122                 | 3.52                           | 9.59                           | 2.64                           | 0.92                           | 0.71                         | 0.01                           | 494                            |      |
|                                  | Cropland, Row Crops              | 330                    | 2.80   | 123                 | 3.50                           | 9.22                           | 2.59                           | 0.92                           | 0.72                         | 0.01                           | 490                            |      |
|                                  | Forest, Mixed                    | 180                    | 1.50   | 19                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.07                         | 0.00                           | 1                              |      |
|                                  | Pasture, Managed                 | 860                    | 7.26   | 40                  | 0.02                           | 0.10                           | 0.02                           | 0.05                           | 1.21                         | 0.09                           | 87                             |      |
|                                  | Rangeland, Brushy                | 400                    | 3.38   | 138                 | 0.07                           | 0.34                           | 0.05                           | 0.03                           | 0.78                         | 0.02                           | 79                             |      |
|                                  | Rangeland                        | 8,430                  | 70.88  | 146                 | 0.03                           | 0.15                           | 0.02                           | 0.01                           | 0.95                         | 0.03                           | 34                             |      |
|                                  | Total Area and Subbasin Averages | 11,900                 | 100.00 | 133                 | 0.62                           | 1.73                           | 0.46                           | 0.17                           | 0.91                         | 0.03                           | 116                            |      |

**Table 15. (Continued)**

| 14-Digit HUC                     | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff (mm) |                                | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha) | Nitrate <sup>3</sup> (kg/ha)   | Soluble P <sup>3</sup> (kg/ha) | FCB |
|----------------------------------|----------------------------------|------------------------|--------|---------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------------------------------|--------------------------------|--------------------------------|-----|
|                                  |                                  |                        |        | Runoff (mm)         | Sed. Yield <sup>2</sup> (t/ha) | Organic N <sup>3</sup> (kg/ha) | Organic P <sup>3</sup> (kg/ha) | Bound P <sup>3</sup> (kg/ha)   | Nitrate <sup>3</sup> (kg/ha) | Soluble P <sup>3</sup> (kg/ha) | FCB                            |     |
| 11030018020070                   | Cropland, Close Grown            | 1,650                  | 22.33  | 115                 | 2.11                           | 4.92                           | 1.65                           | 0.52                           | 0.51                         | 0.01                           | 452                            |     |
|                                  | Cropland, Generic                | 250                    | 3.34   | 118                 | 2.95                           | 6.13                           | 2.04                           | 0.63                           | 0.53                         | 0.01                           | 472                            |     |
|                                  | Cropland, Row Crops              | 650                    | 8.87   | 127                 | 2.85                           | 6.25                           | 2.08                           | 0.60                           | 0.58                         | 0.01                           | 493                            |     |
|                                  | Forest, Mixed                    | 220                    | 2.98   | 18                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.05                         | 0.00                           | 1                              |     |
|                                  | Pasture, Managed                 | 1,280                  | 17.39  | 21                  | 0.01                           | 0.04                           | 0.01                           | 0.02                           | 0.42                         | 0.04                           | 51                             |     |
|                                  | Rangeland, Brushy                | 160                    | 2.16   | 99                  | 0.03                           | 0.13                           | 0.02                           | 0.01                           | 0.47                         | 0.02                           | 28                             |     |
|                                  | Rangeland                        | 3,060                  | 41.44  | 108                 | 0.03                           | 0.10                           | 0.01                           | 0.01                           | 0.49                         | 0.01                           | 22                             |     |
|                                  | Urban, Low Density Resid.        | 110                    | 1.49   | 98                  | 0.06                           | 0.12                           | 0.02                           | 0.03                           | 0.85                         | 0.04                           | 1                              |     |
| Total Area and Subbasin Averages |                                  | 7,370                  | 100.00 | 94                  | 0.84                           | 1.91                           | 0.63                           | 0.20                           | 0.48                         | 0.02                           | 179                            |     |
| 11030018030010                   | Cropland, Close Grown            | 1,970                  | 21.53  | 167                 | 0.86                           | 2.62                           | 0.70                           | 0.38                           | 0.76                         | 0.03                           | 729                            |     |
|                                  | Cropland, Generic                | 300                    | 3.27   | 136                 | 4.79                           | 8.02                           | 2.74                           | 0.96                           | 0.68                         | 0.01                           | 850                            |     |
|                                  | Cropland, Row Crops              | 460                    | 5.06   | 132                 | 4.91                           | 9.64                           | 2.25                           | 1.78                           | 0.83                         | 0.04                           | 307                            |     |
|                                  | Forest, Mixed                    | 260                    | 2.89   | 13                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.04                         | 0.00                           | 1                              |     |
|                                  | Pasture, Managed                 | 1,080                  | 11.76  | 70                  | 0.04                           | 0.19                           | 0.04                           | 0.10                           | 1.34                         | 0.14                           | 100                            |     |
|                                  | Rangeland, Brushy                | 220                    | 2.44   | 110                 | 0.06                           | 0.28                           | 0.04                           | 0.02                           | 0.50                         | 0.02                           | 41                             |     |
|                                  | Rangeland                        | 4,860                  | 53.05  | 157                 | 0.07                           | 0.27                           | 0.04                           | 0.02                           | 0.75                         | 0.02                           | 55                             |     |
|                                  | Total Area and Subbasin Averages | 9,160                  | 100.00 | 141                 | 0.63                           | 1.48                           | 0.38                           | 0.23                           | 0.80                         | 0.04                           | 242                            |     |
| 11030018030020                   | Cropland, Close Grown            | 460                    | 4.83   | 147                 | 4.95                           | 11.37                          | 3.23                           | 1.40                           | 1.54                         | 0.03                           | 609                            |     |
|                                  | Cropland, Generic                | 130                    | 1.33   | 106                 | 3.75                           | 7.10                           | 2.42                           | 1.10                           | 1.02                         | 0.03                           | 503                            |     |
|                                  | Cropland, Row Crops              | 320                    | 3.39   | 124                 | 4.17                           | 9.87                           | 2.91                           | 1.18                           | 1.29                         | 0.03                           | 536                            |     |
|                                  | Forest, Mixed                    | 210                    | 2.15   | 28                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.10                         | 0.00                           | 1                              |     |
|                                  | Pasture, Managed                 | 1,220                  | 12.73  | 63                  | 0.02                           | 0.10                           | 0.02                           | 0.05                           | 2.24                         | 0.13                           | 64                             |     |
|                                  | Rangeland, Brushy                | 260                    | 2.71   | 123                 | 0.04                           | 0.20                           | 0.03                           | 0.01                           | 0.69                         | 0.02                           | 37                             |     |
|                                  | Rangeland                        | 6,960                  | 72.85  | 161                 | 0.03                           | 0.17                           | 0.02                           | 0.01                           | 1.05                         | 0.03                           | 31                             |     |
|                                  | Total Area and Subbasin Averages | 9,560                  | 100.00 | 142                 | 0.46                           | 1.12                           | 0.31                           | 0.14                           | 1.20                         | 0.04                           | 86                             |     |
| 11030018030030                   | Cropland, Close Grown            | 620                    | 7.67   | 162                 | 1.00                           | 3.28                           | 0.79                           | 0.47                           | 0.88                         | 0.04                           | 541                            |     |
|                                  | Cropland, Generic                | 150                    | 1.87   | 130                 | 5.25                           | 10.07                          | 3.14                           | 1.08                           | 0.82                         | 0.01                           | 1,043                          |     |
|                                  | Cropland, Row Crops              | 230                    | 2.85   | 159                 | 6.41                           | 13.05                          | 2.82                           | 2.23                           | 1.42                         | 0.04                           | 363                            |     |
|                                  | Forest, Mixed                    | 180                    | 2.17   | 14                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.05                         | 0.00                           | 1                              |     |
|                                  | Pasture, Managed                 | 610                    | 7.54   | 87                  | 0.05                           | 0.26                           | 0.05                           | 0.11                           | 2.69                         | 0.14                           | 94                             |     |
|                                  | Rangeland, Brushy                | 230                    | 2.77   | 118                 | 0.06                           | 0.26                           | 0.04                           | 0.02                           | 0.76                         | 0.02                           | 37                             |     |
|                                  | Rangeland                        | 6,110                  | 75.13  | 162                 | 0.05                           | 0.22                           | 0.03                           | 0.02                           | 0.97                         | 0.02                           | 42                             |     |
|                                  | Total Area and Subbasin Averages | 8,130                  | 100.00 | 151                 | 0.40                           | 1.00                           | 0.23                           | 0.14                           | 1.08                         | 0.03                           | 111                            |     |
| 11030018030040                   | Cropland, Close Grown            | 1,340                  | 9.85   | 151                 | 4.37                           | 10.86                          | 3.10                           | 0.99                           | 0.94                         | 0.01                           | 565                            |     |
|                                  | Cropland, Generic                | 260                    | 1.94   | 133                 | 3.85                           | 9.26                           | 2.80                           | 0.84                           | 0.82                         | 0.01                           | 522                            |     |
|                                  | Cropland, Row Crops              | 350                    | 2.55   | 173                 | 4.79                           | 12.89                          | 3.49                           | 1.06                           | 1.12                         | 0.01                           | 587                            |     |
|                                  | Forest, Mixed                    | 280                    | 2.03   | 16                  | 0.00                           | 0.01                           | 0.00                           | 0.00                           | 0.06                         | 0.00                           | 1                              |     |
|                                  | Pasture, Managed                 | 870                    | 6.37   | 48                  | 0.02                           | 0.12                           | 0.02                           | 0.06                           | 1.72                         | 0.11                           | 57                             |     |
|                                  | Rangeland, Brushy                | 350                    | 2.56   | 96                  | 0.04                           | 0.24                           | 0.03                           | 0.02                           | 0.65                         | 0.02                           | 30                             |     |
|                                  | Rangeland                        | 10,160                 | 74.70  | 135                 | 0.03                           | 0.16                           | 0.02                           | 0.01                           | 1.03                         | 0.03                           | 20                             |     |
|                                  | Total Area and Subbasin Averages | 13,600                 | 100.00 | 128                 | 0.65                           | 1.71                           | 0.47                           | 0.16                           | 1.03                         | 0.03                           | 100                            |     |

**Table 15. (Continued)**

| 14-Digit HUC                     | Land Use/Cover                   | Sediment Loads (kg/ha) |        |                     |                         |                        |                        |                      |                        |                        |       |
|----------------------------------|----------------------------------|------------------------|--------|---------------------|-------------------------|------------------------|------------------------|----------------------|------------------------|------------------------|-------|
|                                  |                                  | Area <sup>1</sup>      | % Area | Surface Runoff (mm) | Sed. Yield <sup>2</sup> | Organic N <sup>3</sup> | Organic P <sup>3</sup> | Bound P <sup>3</sup> | Nitrate P <sup>3</sup> | Soluble P <sup>3</sup> | FCB   |
| 11030018030050                   | Cropland, Close Grown            | 1,640                  | 16.05  | 182                 | 1.07                    | 3.19                   | 0.86                   | 0.47                 | 0.96                   | 0.04                   | 716   |
|                                  | Cropland, Generic                | 230                    | 2.29   | 156                 | 5.99                    | 10.64                  | 3.53                   | 1.11                 | 0.91                   | 0.01                   | 1,005 |
|                                  | Cropland, Row Crops              | 500                    | 4.90   | 161                 | 6.43                    | 12.52                  | 2.85                   | 2.25                 | 1.19                   | 0.04                   | 345   |
|                                  | Forest, Mixed                    | 270                    | 2.60   | 14                  | 0.00                    | 0.01                   | 0.00                   | 0.00                 | 0.05                   | 0.00                   | 1     |
|                                  | Pasture, Managed                 | 1,320                  | 12.93  | 95                  | 0.06                    | 0.29                   | 0.05                   | 0.14                 | 2.20                   | 0.19                   | 115   |
|                                  | Rangeland, Brushy                | 300                    | 2.96   | 138                 | 0.08                    | 0.38                   | 0.05                   | 0.03                 | 0.75                   | 0.02                   | 51    |
|                                  | Rangeland                        | 5,790                  | 56.52  | 172                 | 0.07                    | 0.31                   | 0.05                   | 0.02                 | 0.85                   | 0.02                   | 60    |
| 11030018030060                   | Urban, Low Density Resid.        | 180                    | 1.75   | 125                 | 0.09                    | 0.27                   | 0.05                   | 0.07                 | 1.50                   | 0.08                   | 1     |
|                                  | Total Area and Subbasin Averages | 10,240                 | 100.00 | 157                 | 0.68                    | 1.60                   | 0.39                   | 0.24                 | 1.05                   | 0.04                   | 205   |
|                                  | Cropland, Close Grown            | 1,980                  | 19.82  | 132                 | 0.65                    | 1.89                   | 0.51                   | 0.30                 | 0.54                   | 0.02                   | 579   |
|                                  | Cropland, Generic                | 280                    | 2.77   | 122                 | 3.88                    | 7.20                   | 2.38                   | 0.77                 | 0.55                   | 0.01                   | 757   |
|                                  | Cropland, Row Crops              | 630                    | 6.33   | 105                 | 3.36                    | 6.85                   | 1.59                   | 1.37                 | 0.56                   | 0.03                   | 219   |
|                                  | Urban/Recreational Grass         | 110                    | 1.10   | 59                  | 0.03                    | 0.13                   | 0.02                   | 0.05                 | 0.73                   | 0.07                   | 1     |
|                                  | Forest, Mixed                    | 260                    | 2.63   | 28                  | 0.01                    | 0.01                   | 0.00                   | 0.00                 | 0.09                   | 0.00                   | 1     |
| 11030018030070                   | Pasture, Managed                 | 1,480                  | 14.82  | 53                  | 0.03                    | 0.12                   | 0.02                   | 0.07                 | 0.76                   | 0.10                   | 86    |
|                                  | Rangeland, Brushy                | 200                    | 1.97   | 98                  | 0.05                    | 0.23                   | 0.03                   | 0.02                 | 0.42                   | 0.02                   | 36    |
|                                  | Rangeland                        | 4,920                  | 49.19  | 127                 | 0.05                    | 0.19                   | 0.03                   | 0.01                 | 0.51                   | 0.01                   | 45    |
|                                  | Urban, Low Density Resid.        | 140                    | 1.37   | 101                 | 0.07                    | 0.15                   | 0.03                   | 0.04                 | 0.90                   | 0.05                   | 1     |
|                                  | Total Area and Subbasin Averages | 10,010                 | 100.00 | 111                 | 0.48                    | 1.13                   | 0.29                   | 0.18                 | 0.55                   | 0.03                   | 185   |
|                                  | Cropland, Close Grown            | 1,540                  | 12.05  | 166                 | 1.34                    | 4.01                   | 1.04                   | 0.60                 | 0.85                   | 0.04                   | 689   |
|                                  | Cropland, Generic                | 290                    | 2.23   | 160                 | 7.78                    | 12.96                  | 4.09                   | 1.38                 | 0.91                   | 0.01                   | 1,049 |
| 11030018030080                   | Cropland, Row Crops              | 530                    | 4.13   | 176                 | 8.79                    | 15.85                  | 3.56                   | 2.63                 | 1.28                   | 0.04                   | 559   |
|                                  | Forest, Mixed                    | 250                    | 1.96   | 34                  | 0.01                    | 0.02                   | 0.00                   | 0.00                 | 0.12                   | 0.00                   | 1     |
|                                  | Pasture, Managed                 | 1,620                  | 12.67  | 97                  | 0.08                    | 0.39                   | 0.07                   | 0.18                 | 2.18                   | 0.18                   | 147   |
|                                  | Rangeland, Brushy                | 440                    | 3.44   | 135                 | 0.10                    | 0.44                   | 0.06                   | 0.03                 | 0.72                   | 0.02                   | 62    |
|                                  | Rangeland                        | 7,850                  | 61.20  | 163                 | 0.13                    | 0.49                   | 0.07                   | 0.04                 | 0.77                   | 0.01                   | 93    |
|                                  | Urban, Low Density Resid.        | 300                    | 2.33   | 92                  | 0.08                    | 0.23                   | 0.04                   | 0.06                 | 1.06                   | 0.05                   | 1     |
|                                  | Total Area and Subbasin Averages | 12,820                 | 100.00 | 150                 | 0.79                    | 1.80                   | 0.42                   | 0.26                 | 0.98                   | 0.04                   | 207   |
| 11030018030080                   | Cropland, Close Grown            | 1,950                  | 25.72  | 123                 | 0.85                    | 2.43                   | 0.64                   | 0.40                 | 0.55                   | 0.03                   | 463   |
|                                  | Cropland, Generic                | 290                    | 3.84   | 122                 | 5.58                    | 8.89                   | 3.02                   | 0.99                 | 0.62                   | 0.01                   | 816   |
|                                  | Cropland, Row Crops              | 420                    | 5.47   | 89                  | 4.18                    | 7.77                   | 1.77                   | 1.60                 | 0.53                   | 0.03                   | 444   |
|                                  | Urban/Recreational Grass         | 120                    | 1.55   | 80                  | 0.07                    | 0.28                   | 0.05                   | 0.12                 | 1.54                   | 0.12                   | 1     |
|                                  | Forest, Mixed                    | 160                    | 2.17   | 21                  | 0.00                    | 0.01                   | 0.00                   | 0.00                 | 0.07                   | 0.00                   | 1     |
|                                  | Pasture, Managed                 | 1,110                  | 14.61  | 41                  | 0.03                    | 0.14                   | 0.03                   | 0.08                 | 0.72                   | 0.09                   | 76    |
|                                  | Rangeland, Brushy                | 190                    | 2.48   | 108                 | 0.06                    | 0.24                   | 0.03                   | 0.02                 | 0.54                   | 0.01                   | 38    |
| 11030018030080                   | Rangeland                        | 3,200                  | 42.10  | 126                 | 0.07                    | 0.23                   | 0.03                   | 0.02                 | 0.56                   | 0.01                   | 48    |
|                                  | Urban, Com./Ind./Trans.          | 160                    | 2.04   | 404                 | 0.36                    | 2.13                   | 0.32                   | 0.34                 | 4.63                   | 0.18                   | 1     |
| Total Area and Subbasin Averages |                                  | 7,590                  | 100.00 | 113                 | 0.70                    | 1.56                   | 0.40                   | 0.26                 | 0.67                   | 0.03                   | 207   |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff |                     | Sed.                 | Organic N            | Organic P            | Bound P              | Sed. Bound P         | Soluble Nitrate      | Soluble P            | FCB |
|----------------|----------------------------------|------------------------|--------|----------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----|
|                |                                  |                        |        | (mm)           | (t/ha) <sup>2</sup> | (kg/ha) <sup>3</sup> |     |
| 11030018030090 | Cropland, Close Grown            | 1,740                  | 18.20  | 94             | 0.70                | 2.12                 | 0.57                 | 0.33                 | 0.35                 | 0.02                 | 360                  |                      |     |
|                | Cropland, Generic                | 220                    | 2.27   | 87             | 4.34                | 7.20                 | 2.41                 | 0.78                 | 0.35                 | 0.01                 | 732                  |                      |     |
|                | Cropland, Row Crops              | 690                    | 7.21   | 111            | 5.25                | 9.75                 | 2.07                 | 1.71                 | 0.64                 | 0.04                 | 371                  |                      |     |
|                | Urban/Recreational Grass         | 190                    | 1.95   | 34             | 0.03                | 0.11                 | 0.02                 | 0.03                 | 0.43                 | 0.03                 | 1                    |                      |     |
|                | Forest, Deciduous                | 10                     | 0.06   | 23             | 0.00                | 0.00                 | 0.00                 | 0.00                 | 0.05                 | 0.00                 | 1                    |                      |     |
|                | Forest, Mixed                    | 340                    | 3.52   | 24             | 0.01                | 0.02                 | 0.00                 | 0.00                 | 0.07                 | 0.00                 | 1                    |                      |     |
|                | Pasture, Managed                 | 1,770                  | 18.50  | 57             | 0.05                | 0.20                 | 0.04                 | 0.08                 | 1.01                 | 0.08                 | 81                   |                      |     |
|                | Rangeland, Brushy                | 300                    | 3.19   | 98             | 0.07                | 0.29                 | 0.04                 | 0.02                 | 0.42                 | 0.01                 | 50                   |                      |     |
|                | Rangeland                        | 3,250                  | 33.98  | 99             | 0.08                | 0.29                 | 0.04                 | 0.02                 | 0.40                 | 0.01                 | 66                   |                      |     |
|                | Urban, Com./Ind./Trans.          | 190                    | 2.02   | 391            | 0.42                | 1.83                 | 0.32                 | 0.28                 | 3.79                 | 0.16                 | 1                    |                      |     |
|                | Urban, High Density Resid.       | 190                    | 1.94   | 298            | 0.33                | 1.43                 | 0.25                 | 0.21                 | 2.87                 | 0.14                 | 1                    |                      |     |
|                | Urban, Low Density Resid.        | 560                    | 5.90   | 81             | 0.07                | 0.16                 | 0.03                 | 0.05                 | 0.85                 | 0.04                 | 1                    |                      |     |
|                | Urban, Medium Density Resid.     | 10                     | 0.07   | 207            | 0.36                | 0.42                 | 0.17                 | 0.06                 | 1.96                 | 0.11                 | 1                    |                      |     |
|                | Wetland, Herbaceous              | 120                    | 1.21   | 130            | 0.11                | 0.51                 | 0.10                 | 0.02                 | 0.40                 | 0.00                 | 1                    |                      |     |
| 11060001010010 | Total Area and Subbasin Averages | 9,560                  | 100.00 | 96             | 0.67                | 1.48                 | 0.34                 | 0.24                 | 0.65                 | 0.03                 | 148                  |                      |     |
|                | Cropland, Close Grown            | 1,810                  | 13.35  | 173            | 0.94                | 3.21                 | 0.77                 | 0.44                 | 0.96                 | 0.04                 | 657                  |                      |     |
|                | Cropland, Generic                | 420                    | 3.10   | 147            | 5.58                | 11.82                | 3.53                 | 1.16                 | 1.00                 | 0.01                 | 1,079                |                      |     |
|                | Cropland, Row Crops              | 590                    | 4.38   | 171            | 6.44                | 14.26                | 2.98                 | 2.40                 | 1.52                 | 0.04                 | 356                  |                      |     |
|                | Forest, Mixed                    | 290                    | 2.12   | 27             | 0.00                | 0.01                 | 0.00                 | 0.00                 | 0.10                 | 0.00                 | 1                    |                      |     |
|                | Pasture, Managed                 | 1,950                  | 14.45  | 93             | 0.05                | 0.24                 | 0.04                 | 0.11                 | 3.08                 | 0.17                 | 87                   |                      |     |
|                | Rangeland, Brushy                | 370                    | 2.76   | 116            | 0.06                | 0.26                 | 0.03                 | 0.02                 | 0.72                 | 0.01                 | 36                   |                      |     |
|                | Rangeland                        | 8,090                  | 59.84  | 159            | 0.04                | 0.17                 | 0.02                 | 0.01                 | 0.90                 | 0.01                 | 33                   |                      |     |
|                | Total Area and Subbasin Averages | 13,520                 | 100.00 | 147            | 0.61                | 1.56                 | 0.36                 | 0.22                 | 1.23                 | 0.04                 | 170                  |                      |     |
| 11060001010020 | Cropland, Close Grown            | 860                    | 9.20   | 163            | 1.52                | 5.11                 | 1.18                 | 0.72                 | 0.86                 | 0.04                 | 654                  |                      |     |
|                | Cropland, Generic                | 170                    | 1.82   | 142            | 9.10                | 14.46                | 4.35                 | 1.57                 | 0.82                 | 0.01                 | 968                  |                      |     |
|                | Cropland, Row Crops              | 330                    | 3.49   | 197            | 12.21               | 20.23                | 4.36                 | 3.18                 | 1.58                 | 0.04                 | 597                  |                      |     |
|                | Forest, Mixed                    | 310                    | 3.33   | 43             | 0.01                | 0.03                 | 0.00                 | 0.00                 | 0.17                 | 0.00                 | 1                    |                      |     |
|                | Pasture, Managed                 | 940                    | 10.03  | 105            | 0.10                | 0.45                 | 0.08                 | 0.20                 | 2.54                 | 0.17                 | 162                  |                      |     |
|                | Rangeland, Brushy                | 460                    | 4.87   | 129            | 0.11                | 0.49                 | 0.07                 | 0.04                 | 0.73                 | 0.02                 | 70                   |                      |     |
|                | Rangeland                        | 6,180                  | 65.79  | 164            | 0.08                | 0.27                 | 0.04                 | 0.02                 | 0.83                 | 0.01                 | 52                   |                      |     |
|                | Wetland, Herbaceous              | 140                    | 1.45   | 188            | 0.18                | 0.86                 | 0.17                 | 0.04                 | 0.75                 | 0.01                 | 1                    |                      |     |
|                | Total Area and Subbasin Averages | 9,390                  | 100.00 | 154            | 0.80                | 1.70                 | 0.38                 | 0.24                 | 1.00                 | 0.03                 | 152                  |                      |     |
| 11060001020010 | Forest, Mixed                    | 140                    | 1.10   | 16             | 0.01                | 0.02                 | 0.00                 | 0.00                 | 0.06                 | 0.00                 | 1                    |                      |     |
|                | Pasture, Managed                 | 2,450                  | 19.33  | 109            | 0.05                | 0.28                 | 0.05                 | 0.10                 | 3.42                 | 0.20                 | 122                  |                      |     |
|                | Rangeland, Brushy                | 190                    | 1.51   | 89             | 0.04                | 0.25                 | 0.04                 | 0.02                 | 0.48                 | 0.02                 | 47                   |                      |     |
|                | Rangeland                        | 9,880                  | 78.05  | 153            | 0.06                | 0.32                 | 0.04                 | 0.02                 | 0.98                 | 0.02                 | 62                   |                      |     |
|                | Total Area and Subbasin Averages | 12,660                 | 100.00 | 142            | 0.06                | 0.31                 | 0.04                 | 0.04                 | 1.43                 | 0.06                 | 73                   |                      |     |
| 11060001020020 | Cropland, Generic                | 140                    | 1.33   | 142            | 4.46                | 11.88                | 3.01                 | 0.99                 | 1.02                 | 0.02                 | 556                  |                      |     |
|                | Forest, Mixed                    | 180                    | 1.74   | 19             | 0.01                | 0.02                 | 0.00                 | 0.00                 | 0.07                 | 0.00                 | 1                    |                      |     |
|                | Pasture, Managed                 | 1,300                  | 12.35  | 91             | 0.04                | 0.23                 | 0.04                 | 0.11                 | 3.42                 | 0.19                 | 50                   |                      |     |
|                | Rangeland, Brushy                | 220                    | 2.11   | 109            | 0.06                | 0.33                 | 0.05                 | 0.02                 | 0.59                 | 0.02                 | 55                   |                      |     |
|                | Rangeland                        | 8,710                  | 82.47  | 161            | 0.07                | 0.35                 | 0.05                 | 0.02                 | 1.02                 | 0.02                 | 59                   |                      |     |
|                | Total Area and Subbasin Averages | 10,560                 | 100.00 | 149            | 0.12                | 0.48                 | 0.09                 | 0.05                 | 1.29                 | 0.05                 | 63                   |                      |     |

**Table 15. (Continued)**

| 14-Digit HUC   | Land Use/Cover                   | Area <sup>1</sup> (ha) | % Area | Surface Runoff |                     | Sed.                 | Organic N            | Organic P            | Bound P              | Soluble Nitrate      | Soluble P            | FCB |
|----------------|----------------------------------|------------------------|--------|----------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----|
|                |                                  |                        |        | (mm)           | (t/ha) <sup>2</sup> | (kg/ha) <sup>3</sup> |     |
| 11060001020030 | Cropland, Close Grown            | 150                    | 1.18   | 130            | 1.39                | 5.45                 | 1.26                 | 0.61                 | 0.60                 | 0.03                 | 606                  |     |
|                | Forest, Mixed                    | 290                    | 2.27   | 25             | 0.01                | 0.03                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 2,360                  | 18.77  | 107            | 0.07                | 0.36                 | 0.06                 | 0.17                 | 3.40                 | 0.21                 | 101                  |     |
|                | Rangeland, Brushy                | 360                    | 2.83   | 114            | 0.11                | 0.62                 | 0.09                 | 0.05                 | 0.70                 | 0.03                 | 79                   |     |
|                | Rangeland                        | 9,430                  | 74.96  | 153            | 0.10                | 0.53                 | 0.08                 | 0.03                 | 0.84                 | 0.02                 | 86                   |     |
|                | Total Area and Subbasin Averages | 12,580                 | 100.00 | 140            | 0.11                | 0.54                 | 0.09                 | 0.07                 | 1.30                 | 0.06                 | 93                   |     |
| 11060001020040 | Cropland, Close Grown            | 440                    | 3.68   | 141            | 1.45                | 5.29                 | 1.22                 | 0.64                 | 0.67                 | 0.03                 | 593                  |     |
|                | Cropland, Generic                | 130                    | 1.13   | 125            | 7.33                | 15.31                | 4.14                 | 1.23                 | 0.74                 | 0.01                 | 1,079                |     |
|                | Cropland, Row Crops              | 280                    | 2.40   | 128            | 8.82                | 16.07                | 3.50                 | 2.38                 | 0.88                 | 0.03                 | 333                  |     |
|                | Forest, Mixed                    | 320                    | 2.66   | 26             | 0.01                | 0.03                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 1,470                  | 12.44  | 79             | 0.09                | 0.45                 | 0.08                 | 0.21                 | 2.10                 | 0.15                 | 126                  |     |
|                | Rangeland, Brushy                | 420                    | 3.58   | 121            | 0.11                | 0.56                 | 0.08                 | 0.04                 | 0.74                 | 0.02                 | 74                   |     |
| 11060001020050 | Rangeland                        | 8,770                  | 74.11  | 156            | 0.11                | 0.53                 | 0.08                 | 0.04                 | 0.84                 | 0.02                 | 95                   |     |
|                | Total Area and Subbasin Averages | 11,830                 | 100.00 | 140            | 0.45                | 1.23                 | 0.25                 | 0.15                 | 0.96                 | 0.04                 | 131                  |     |
|                | Cropland, Close Grown            | 400                    | 4.25   | 130            | 1.43                | 5.14                 | 1.21                 | 0.63                 | 0.61                 | 0.03                 | 560                  |     |
|                | Cropland, Generic                | 110                    | 1.13   | 138            | 8.60                | 15.21                | 4.51                 | 1.21                 | 0.84                 | 0.01                 | 1,181                |     |
|                | Cropland, Row Crops              | 210                    | 2.26   | 161            | 11.07               | 18.75                | 4.24                 | 2.75                 | 1.21                 | 0.03                 | 414                  |     |
|                | Forest, Mixed                    | 230                    | 2.44   | 35             | 0.01                | 0.04                 | 0.00                 | 0.00                 | 0.12                 | 0.00                 | 1                    |     |
| 11060001020060 | Pasture, Managed                 | 1,050                  | 11.04  | 87             | 0.09                | 0.47                 | 0.08                 | 0.23                 | 2.44                 | 0.17                 | 123                  |     |
|                | Rangeland, Brushy                | 370                    | 3.92   | 115            | 0.12                | 0.64                 | 0.09                 | 0.05                 | 0.67                 | 0.02                 | 83                   |     |
|                | Rangeland                        | 7,110                  | 74.95  | 155            | 0.10                | 0.46                 | 0.07                 | 0.03                 | 0.78                 | 0.02                 | 83                   |     |
|                | Total Area and Subbasin Averages | 9,480                  | 100.00 | 142            | 0.50                | 1.23                 | 0.26                 | 0.15                 | 0.95                 | 0.04                 | 125                  |     |
|                | Cropland, Close Grown            | 200                    | 1.82   | 148            | 1.57                | 5.19                 | 1.29                 | 0.68                 | 0.75                 | 0.03                 | 622                  |     |
|                | Cropland, Generic                | 110                    | 1.02   | 127            | 8.13                | 16.37                | 4.52                 | 1.30                 | 0.79                 | 0.01                 | 1,126                |     |
| 11060001020070 | Cropland, Row Crops              | 140                    | 1.28   | 157            | 10.23               | 18.33                | 4.01                 | 2.73                 | 1.24                 | 0.03                 | 376                  |     |
|                | Forest, Mixed                    | 170                    | 1.56   | 25             | 0.01                | 0.03                 | 0.00                 | 0.00                 | 0.09                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 660                    | 5.94   | 82             | 0.09                | 0.47                 | 0.08                 | 0.22                 | 2.26                 | 0.17                 | 120                  |     |
|                | Rangeland, Brushy                | 360                    | 3.17   | 102            | 0.11                | 0.62                 | 0.09                 | 0.05                 | 0.61                 | 0.03                 | 76                   |     |
|                | Rangeland                        | 9,540                  | 85.21  | 152            | 0.12                | 0.58                 | 0.09                 | 0.04                 | 0.80                 | 0.02                 | 96                   |     |
|                | Total Area and Subbasin Averages | 11,190                 | 100.00 | 144            | 0.35                | 1.04                 | 0.20                 | 0.11                 | 0.87                 | 0.03                 | 119                  |     |
|                | Cropland, Close Grown            | 230                    | 3.04   | 133            | 1.75                | 6.16                 | 1.40                 | 0.78                 | 0.61                 | 0.03                 | 640                  |     |
|                | Cropland, Generic                | 120                    | 1.54   | 116            | 9.53                | 17.25                | 4.56                 | 1.44                 | 0.57                 | 0.01                 | 1,051                |     |
|                | Cropland, Row Crops              | 130                    | 1.68   | 156            | 11.80               | 18.25                | 3.83                 | 2.86                 | 1.04                 | 0.04                 | 494                  |     |
|                | Forest, Mixed                    | 200                    | 2.59   | 31             | 0.01                | 0.04                 | 0.01                 | 0.00                 | 0.11                 | 0.00                 | 1                    |     |
|                | Pasture, Managed                 | 560                    | 7.35   | 67             | 0.09                | 0.45                 | 0.08                 | 0.18                 | 1.40                 | 0.11                 | 123                  |     |
|                | Rangeland, Brushy                | 350                    | 4.62   | 114            | 0.15                | 0.69                 | 0.09                 | 0.05                 | 0.58                 | 0.02                 | 101                  |     |
|                | Rangeland                        | 5,900                  | 78.01  | 149            | 0.15                | 0.53                 | 0.08                 | 0.04                 | 0.67                 | 0.01                 | 103                  |     |
|                | Wetland, Herbaceous              | 90                     | 1.17   | 171            | 0.23                | 1.19                 | 0.22                 | 0.05                 | 0.61                 | 0.01                 | 1                    |     |
|                | Total Area and Subbasin Averages | 7,570                  | 100.00 | 138            | 0.53                | 1.26                 | 0.25                 | 0.14                 | 0.71                 | 0.02                 | 138                  |     |

**Table 15. (Continued)**

| 14-Digit HUC                     | Land Use/Cover        | Area <sup>1</sup> (ha) | % Area | Surface Runoff |                     | Sed.                 | Organic N            | Organic P            | Bound P              | Soluble Nitrate      | Soluble P            | FCB |
|----------------------------------|-----------------------|------------------------|--------|----------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----|
|                                  |                       |                        |        | (mm)           | (t/ha) <sup>2</sup> | (kg/ha) <sup>3</sup> |     |
| 11060001020080                   | Cropland, Close Grown | 220                    | 2.85   | 120            | 1.49                | 4.09                 | 1.15                 | 0.65                 | 0.54                 | 0.02                 | 610                  |     |
|                                  | Cropland, Generic     | 120                    | 1.56   | 152            | 10.45               | 14.46                | 4.51                 | 1.50                 | 0.80                 | 0.01                 | 1,131                |     |
|                                  | Cropland, Row Crops   | 190                    | 2.48   | 132            | 8.74                | 13.03                | 2.92                 | 2.47                 | 0.87                 | 0.04                 | 436                  |     |
|                                  | Forest, Mixed         | 220                    | 2.92   | 24             | 0.01                | 0.02                 | 0.00                 | 0.00                 | 0.08                 | 0.00                 | 1                    |     |
|                                  | Pasture, Managed      | 940                    | 12.31  | 65             | 0.08                | 0.34                 | 0.06                 | 0.14                 | 1.35                 | 0.09                 | 107                  |     |
|                                  | Rangeland, Brushy     | 420                    | 5.56   | 105            | 0.11                | 0.43                 | 0.06                 | 0.03                 | 0.52                 | 0.01                 | 69                   |     |
|                                  | Rangeland             | 5,380                  | 70.84  | 157            | 0.16                | 0.54                 | 0.08                 | 0.04                 | 0.70                 | 0.01                 | 105                  |     |
|                                  | Wetland, Herbaceous   | 110                    | 1.48   | 171            | 0.17                | 0.74                 | 0.14                 | 0.04                 | 0.61                 | 0.01                 | 1                    |     |
| Total Area and Subbasin Averages |                       | 7,600                  | 100.00 | 137            | 0.55                | 1.12                 | 0.24                 | 0.15                 | 0.75                 | 0.02                 | 137                  |     |

<sup>1</sup>1 ha = 2.47 ac, <sup>2</sup>1 t/ha = 0.446 T/ac, <sup>3</sup>1 kg/ha = 0.89 lb/ac

**Table 16.** Estimated average annual sediment, nutrient, and bacterial export rates in the full Walnut River/Grouse Creek Watershed by land use  
 (1 ha = 2.47 ac., 1 t/ha = 0.446 T/ac, 1 kg/ha = 0.89 lb/ac).

| Land Use/Cover                              | Area (ha)      | Percent Area  | Surface Runoff (mm) | Sediment Yield (t/ha) | Org. N (kg/ha) | Org. P (kg/ha) | Bound P (kg/ha) | Sed. Nitrate (kg/ha) | Sol. P (kg/ha) | Fecal Coliform Bacteria (ct/100ml) |
|---|----------------|---------------|---------------------|-----------------------|----------------|----------------|-----------------|----------------------|----------------|------------------------------------|
| Cropland, Close Grown                       | 52,101         | 8.34          | 171                 | 1.45                  | 4.34           | 1.13           | 0.51            | 0.95                 | 0.03           | 430                                |
| Cropland, Generic                           | 16,482         | 2.64          | 160                 | 4.92                  | 11.85          | 3.31           | 1.12            | 1.02                 | 0.01           | 850                                |
| Cropland, Row Crops                         | 49,887         | 7.98          | 169                 | 4.63                  | 12.08          | 2.60           | 1.87            | 1.37                 | 0.05           | 467                                |
| Urban/Recreational Grass                    | 1,618          | 0.26          | 86                  | 0.04                  | 0.20           | 0.03           | 0.07            | 1.72                 | 0.10           | 1                                  |
| Forest, Deciduous                           | 6              | 0.00          | 23                  | 0.00                  | 0.00           | 0.00           | 0.00            | 0.05                 | 0.00           | 1                                  |
| Forest, Mixed                               | 13,026         | 2.08          | 23                  | 0.00                  | 0.02           | 0.00           | 0.00            | 0.08                 | 0.00           | 1                                  |
| Pasture, Managed                            | 82,393         | 13.19         | 73                  | 0.04                  | 0.20           | 0.04           | 0.10            | 2.33                 | 0.16           | 105                                |
| Rangeland, Brushy                           | 14,957         | 2.39          | 124                 | 0.07                  | 0.37           | 0.05           | 0.03            | 0.73                 | 0.02           | 61                                 |
| Rangeland                                   | 388,559        | 62.19         | 165                 | 0.06                  | 0.29           | 0.04           | 0.02            | 1.00                 | 0.03           | 57                                 |
| Urban, Commercial/Industrial/Transportation | 1,333          | 0.21          | 398                 | 0.34                  | 2.03           | 0.32           | 0.22            | 4.44                 | 0.18           | 1                                  |
| Urban, High Density Residential             | 567            | 0.09          | 326                 | 0.32                  | 1.52           | 0.27           | 0.15            | 3.39                 | 0.15           | 1                                  |
| Urban, Low Density Residential              | 3,276          | 0.52          | 128                 | 0.07                  | 0.22           | 0.04           | 0.05            | 1.38                 | 0.06           | 1                                  |
| Urban, Medium Density Residential           | 133            | 0.02          | 264                 | 0.24                  | 0.66           | 0.16           | 0.08            | 2.83                 | 0.13           | 1                                  |
| Wetland, Herbaceous                         | 462            | 0.07          | 166                 | 0.16                  | 0.80           | 0.15           | 0.04            | 0.60                 | 0.01           | 1                                  |
| <b>Basin Total and Averages</b>             | <b>624,800</b> | <b>100.00</b> | <b>150</b>          | <b>0.67</b>           | <b>1.86</b>    | <b>0.42</b>    | <b>0.25</b>     | <b>1.19</b>          | <b>0.05</b>    | <b>146</b>                         |

**Table 17.** Estimated average annual sediment, nutrient, and bacterial export rates in the Walnut River Basin and the Grouse Creek Basin by land use (1 ha = 2.47 ac., 1 t/ha = 0.446 T/ac, 1 kg/ha = 0.89 lb/ac).

| Basin              | Land Use/Cover                  | Area (ha)      | Percent Area  | Surface Runoff (mm) | Sediment Yield (t/ha) | Org. N (kg/ha) | Org. P (kg/ha) | Sed. Bound P (kg/ha) |                 | Sol. P (kg/ha) | Fecal Coliform Bacteria (ct/100ml) |
|--------------------|---------------------------------|----------------|---------------|---------------------|-----------------------|----------------|----------------|----------------------|-----------------|----------------|------------------------------------|
|                    |                                 |                |               |                     |                       |                |                | Bound P              | Nitrate (kg/ha) |                |                                    |
| Walnut River Basin | Cropland, Close Grown           | 47.795         | 9.22          | 173                 | 1.47                  | 4.34           | 1.13           | 0.50                 | 0.96            | 0.03           | 411                                |
|                    | Cropland, Generic               | 15.162         | 2.92          | 161                 | 4.71                  | 11.67          | 3.25           | 1.11                 | 1.04            | 0.01           | 835                                |
|                    | Cropland, Row Crops             | 48.011         | 9.26          | 170                 | 4.46                  | 11.91          | 2.57           | 1.84                 | 1.38            | 0.05           | 468                                |
|                    | Urban/Recreational Grass        | 1.618          | 0.31          | 86                  | 0.04                  | 0.20           | 0.03           | 0.07                 | 1.72            | 0.10           | 1                                  |
|                    | Forest, Deciduous               | 6              | 0.00          | 23                  | 0.00                  | 0.00           | 0.00           | 0.00                 | 0.05            | 0.00           | 1                                  |
|                    | Forest, Mixed                   | 10.678         | 2.06          | 22                  | 0.00                  | 0.01           | 0.00           | 0.00                 | 0.07            | 0.00           | 1                                  |
|                    | Pasture, Managed                | 68.712         | 13.25         | 69                  | 0.03                  | 0.18           | 0.03           | 0.09                 | 2.23            | 0.16           | 105                                |
|                    | Rangeland, Brushy               | 11.434         | 2.21          | 127                 | 0.06                  | 0.33           | 0.05           | 0.02                 | 0.76            | 0.02           | 58                                 |
|                    | Rangeland                       | 309.589        | 59.72         | 167                 | 0.05                  | 0.25           | 0.04           | 0.02                 | 1.04            | 0.03           | 52                                 |
|                    | Urban, Comm./Ind./Trans.        | 1,333          | 0.26          | 398                 | 0.34                  | 2.03           | 0.32           | 0.22                 | 4.44            | 0.18           | 1                                  |
|                    | Urban, High Dens. Resid.        | 567            | 0.11          | 326                 | 0.32                  | 1.52           | 0.27           | 0.15                 | 3.39            | 0.15           | 1                                  |
|                    | Urban, Low Dens. Resid.         | 3,276          | 0.63          | 128                 | 0.07                  | 0.22           | 0.04           | 0.05                 | 1.38            | 0.06           | 1                                  |
|                    | Urban, Medium Dens. Resid.      | 133            | 0.03          | 264                 | 0.24                  | 0.66           | 0.16           | 0.08                 | 2.83            | 0.13           | 1                                  |
|                    | Wetland, Herbaceous             | 123            | 0.02          | 133                 | 0.11                  | 0.50           | 0.10           | 0.02                 | 0.41            | 0.00           | 1                                  |
|                    | <b>Basin Total and Averages</b> | <b>518.439</b> | <b>100.00</b> | <b>151</b>          | <b>0.72</b>           | <b>2.03</b>    | <b>0.46</b>    | <b>0.27</b>          | <b>1.21</b>     | <b>0.05</b>    | <b>152</b>                         |
| Grouse Creek Basin | Cropland, Close Grown           | 4,305          | 4.05          | 156                 | 1.27                  | 4.36           | 1.03           | 0.58                 | 0.82            | 0.04           | 634                                |
|                    | Cropland, Generic               | 1,320          | 1.24          | 139                 | 7.35                  | 13.91          | 3.99           | 1.27                 | 0.87            | 0.01           | 1,024                              |
|                    | Cropland, Row Crops             | 1,877          | 1.76          | 162                 | 9.22                  | 16.55          | 3.58           | 2.64                 | 1.28            | 0.04           | 420                                |
|                    | Urban/Recreational Grass        | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Forest, Deciduous               | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Forest, Mixed                   | 2,348          | 2.21          | 28                  | 0.01                  | 0.03           | 0.00           | 0.00                 | 0.10            | 0.00           | 1                                  |
|                    | Pasture, Managed                | 13,681         | 12.86         | 94                  | 0.07                  | 0.35           | 0.06           | 0.15                 | 2.81            | 0.17           | 109                                |
|                    | Rangeland, Brushy               | 3,522          | 3.31          | 113                 | 0.10                  | 0.51           | 0.07           | 0.04                 | 0.65            | 0.02           | 71                                 |
|                    | Rangeland                       | 78,970         | 74.25         | 156                 | 0.10                  | 0.43           | 0.06           | 0.03                 | 0.85            | 0.02           | 76                                 |
|                    | Urban, Comm./Ind./Trans.        | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Urban, High Dens. Resid.        | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Urban, Low Dens. Resid.         | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Urban, Medium Dens. Resid.      | 0              | 0.00          | ---                 | ---                   | ---            | ---            | ---                  | ---             | ---            | ---                                |
|                    | Wetland, Herbaceous             | 338            | 0.32          | 178                 | 0.19                  | 0.90           | 0.17           | 0.04                 | 0.66            | 0.01           | 1                                  |
|                    | <b>Basin Total and Averages</b> | <b>106.361</b> | <b>100.00</b> | <b>143</b>          | <b>0.39</b>           | <b>1.02</b>    | <b>0.21</b>    | <b>0.13</b>          | <b>1.08</b>     | <b>0.04</b>    | <b>119</b>                         |

**Table 18. Estimated average annual sediment and nutrient loads, and percent total load, by land use in the full Walnut River/Grouse Creek Watershed (1 ha = 2.47 ac., 1 t = 1.1 T, 1 kg = 2.2 lb).**

| Land Use/Cover                  | Area (ha)      | Percent Area  | Sed. Yield (t/yr) | Sed. Yield % Total | Org. N (kg/yr)   | Org. N % Total | Org. P (kg/yr) | Org. P % Total | Sed. P (kg/yr) | Sed. P % Total | Nitrate (kg/yr) | Nitrate % Total | Sol. P (kg/yr) | Sol. P % Total | FCB ct         | FCB % Total   |
|---------------------------------|----------------|---------------|-------------------|--------------------|------------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|----------------|----------------|----------------|---------------|
| Cropland, Close Grown           | 52,101         | 8.34          | 75,803            | 18.17              | 226,267          | 19.46          | 58,628         | 22.25          | 26,549         | 17.06          | 49,615          | 6.67            | 1,693          | 5.77           | 3.8E+12        | 26.62         |
| Cropland, Generic               | 16,482         | 2.64          | 81,154            | 19.45              | 195,292          | 16.79          | 54,569         | 20.71          | 18,540         | 11.91          | 16,857          | 2.27            | 236            | 0.80           | 2.2E+12        | 15.53         |
| Cropland, Row Crops             | 49,887         | 7.98          | 231,245           | 55.43              | 602,814          | 51.84          | 129,913        | 49.31          | 93,314         | 59.95          | 68,572          | 9.22            | 2,516          | 8.57           | 3.9E+12        | 27.35         |
| Urban/Recreational Grass        | 1,618          | 0.26          | 71                | 0.02               | 323              | 0.03           | 52             | 0.02           | 108            | 0.07           | 2,782           | 0.37            | 165            | 0.56           | 1.4E+08        | 0.00          |
| Forest, Deciduous               | 6              | 0.00          | 0                 | 0.00               | 0                | 0.00           | 0              | 0.00           | 0              | 0.00           | 0               | 0.00            | 0              | 0.00           | 1.3E+05        | 0.00          |
| Forest, Mixed                   | 13,026         | 2.08          | 64                | 0.02               | 205              | 0.02           | 27             | 0.01           | 26             | 0.02           | 1,034           | 0.14            | 15             | 0.05           | 3.0E+08        | 0.00          |
| Pasture, Managed                | 82,393         | 13.19         | 3,078             | 0.74               | 16,823           | 1.45           | 2,898          | 1.10           | 8,000          | 5.14           | 191,717         | 25.77           | 13,590         | 46.29          | 6.3E+11        | 4.41          |
| Rangeland, Brushy               | 14,957         | 2.39          | 1,090             | 0.26               | 5,575            | 0.48           | 759            | 0.29           | 414            | 0.27           | 10,920          | 1.47            | 347            | 1.18           | 1.1E+11        | 0.78          |
| Rangeland                       | 388,559        | 62.19         | 23,696            | 5.68               | 110,869          | 9.53           | 15,809         | 6.00           | 8,134          | 5.23           | 389,507         | 52.35           | 10,244         | 34.89          | 3.6E+12        | 25.30         |
| Urban, Comm./Ind./Trans.        | 1,333          | 0.21          | 453               | 0.11               | 2,706            | 0.23           | 423            | 0.16           | 289            | 0.19           | 5,923           | 0.80            | 234            | 0.80           | 5.3E+08        | 0.00          |
| Urban, High Dens. Resid.        | 567            | 0.09          | 180               | 0.04               | 863              | 0.07           | 152            | 0.06           | 86             | 0.06           | 1,926           | 0.26            | 85             | 0.29           | 1.8E+08        | 0.00          |
| Urban, Low Dens. Resid.         | 3,276          | 0.52          | 238               | 0.06               | 734              | 0.06           | 137            | 0.05           | 166            | 0.11           | 4,528           | 0.61            | 211            | 0.72           | 4.2E+08        | 0.00          |
| Urban, Medium Dens. Resid.      | 133            | 0.02          | 33                | 0.01               | 88               | 0.01           | 21             | 0.01           | 11             | 0.01           | 377             | 0.05            | 17             | 0.06           | 3.5E+07        | 0.00          |
| Wetland, Herbaceous             | 462            | 0.07          | 76                | 0.02               | 368              | 0.03           | 70             | 0.03           | 17             | 0.01           | 276             | 0.04            | 3              | 0.01           | 7.7E+07        | 0.00          |
| <b>Basin Total and Averages</b> | <b>624,800</b> | <b>100.00</b> | <b>417,178</b>    | <b>100.00</b>      | <b>1,162,926</b> | <b>100.00</b>  | <b>263,458</b> | <b>100.00</b>  | <b>155,654</b> | <b>100.00</b>  | <b>744,034</b>  | <b>100.00</b>   | <b>29,356</b>  | <b>100.00</b>  | <b>1.4E+13</b> | <b>100.00</b> |

**Table 19.** Estimated average annual sediment and nutrient loads, and percent total load, by land use in the Walnut River Basin and the Grouse Creek Basin (1 ha = 2.47 ac., 1 t = 1.1 T, 1 kg = 2.2 lb).

| Basin                           | Land Use/Cover             | Area (ha)      | Percent Area  | Sed. Yield     | Sed. Yield    | Org. N           | Org. N        | Org. P         | Org. P        | Sed. P         | Sed. P        | Nitrate        | Nitrate       | Sol. P        | Sol. P        | FCB            | FCB           |
|---------------------------------|----------------------------|----------------|---------------|----------------|---------------|------------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|---------------|---------------|----------------|---------------|
|                                 |                            |                |               | %              | (t/yr)        | Total            | (kg/yr)       | Total          | (kg/yr)       | Total          | (kg/yr)       | %              | %             | Total         | %             | Total          | Total         |
| Walnut River Basin              | Cronland, Close Grown      | 47,795         | 9.22          | 70,330         | 18.72         | 207,512          | 19.69         | 54,179         | 22.48         | 24,041         | 16.95         | 46,099         | 7.33          | 1,542         | 6.12          | 3.4E+12        | 27.10         |
|                                 | Cropland, Generic          | 15,162         | 2.92          | 71,455         | 19.02         | 176,933          | 16.79         | 49,307         | 20.46         | 16,857         | 11.88         | 15,714         | 2.50          | 221           | 0.88          | 2.0E+12        | 16.33         |
|                                 | Cropland, Row Crops        | 48,011         | 9.26          | 213,941        | 56.94         | 571,763          | 54.24         | 123,202        | 51.13         | 88,369         | 62.30         | 66,169         | 10.52         | 2,445         | 9.71          | 3.8E+12        | 30.46         |
|                                 | Urban/Recreational Grass   | 1,618          | 0.31          | 71             | 0.02          | 323              | 0.03          | 52             | 0.02          | 108            | 0.08          | 2,782          | 0.44          | 165           | 0.66          | 1.4E+08        | 0.00          |
|                                 | Forest, Deciduous          | 6              | 0.00          | 0              | 0.00          | 0                | 0.00          | 0              | 0.00          | 0              | 0.00          | 0              | 0.00          | 0             | 0.00          | 1.3E+05        | 0.00          |
|                                 | Forest, Mixed              | 10,678         | 2.06          | 43             | 0.01          | 141              | 0.01          | 19             | 0.01          | 19             | 0.01          | 793            | 0.13          | 11            | 0.05          | 2.3E+08        | 0.00          |
|                                 | Pasture, Managed           | 68,712         | 13.25         | 2,160          | 0.57          | 12,048           | 1.14          | 2,062          | 0.86          | 5,885          | 4.15          | 153,251        | 24.38         | 11,200        | 44.47         | 5.0E+11        | 3.97          |
|                                 | Rangeland, Brushv          | 11,434         | 2.21          | 729            | 0.19          | 3,792            | 0.36          | 516            | 0.21          | 277            | 0.20          | 8,639          | 1.37          | 278           | 1.10          | 8.4E+10        | 0.67          |
|                                 | Rangeland                  | 309,589        | 59.72         | 16,100         | 4.28          | 77,133           | 7.32          | 10,884         | 4.52          | 5,743          | 4.05          | 322,435        | 51.29         | 8,777         | 34.84         | 2.7E+12        | 21.47         |
|                                 | Urban, Comm./Ind./Trans.   | 1,333          | 0.26          | 453            | 0.12          | 2,706            | 0.26          | 423            | 0.18          | 289            | 0.20          | 5,923          | 0.94          | 234           | 0.93          | 5.3E+08        | 0.00          |
|                                 | Urban, High Dens. Resid.   | 567            | 0.11          | 180            | 0.05          | 863              | 0.08          | 152            | 0.06          | 86             | 0.06          | 1,926          | 0.31          | 85            | 0.34          | 1.8E+08        | 0.00          |
|                                 | Urban, Low Dens. Resid.    | 3,276          | 0.63          | 238            | 0.06          | 734              | 0.07          | 137            | 0.06          | 166            | 0.12          | 4,528          | 0.72          | 211           | 0.84          | 4.2E+08        | 0.00          |
|                                 | Urban, Medium Dens. Resid. | 133            | 0.03          | 33             | 0.01          | 88               | 0.01          | 21             | 0.01          | 11             | 0.01          | 377            | 0.06          | 17            | 0.07          | 3.5E+07        | 0.00          |
|                                 | Wetland, Herbaceous        | 123            | 0.02          | 13             | 0.00          | 62               | 0.01          | 12             | 0.00          | 2              | 0.00          | 51             | 0.01          | 0             | 0.00          | 1.6E+07        | 0.00          |
| <b>Basin Total and Averages</b> |                            | <b>518,439</b> | <b>100.00</b> | <b>375,746</b> | <b>100.00</b> | <b>1,054,100</b> | <b>100.00</b> | <b>240,967</b> | <b>100.00</b> | <b>141,852</b> | <b>100.00</b> | <b>628,686</b> | <b>100.00</b> | <b>25,188</b> | <b>100.00</b> | <b>1.3E+13</b> | <b>100.00</b> |
| Grouse Creek Basin              | Cropland, Close Grown      | 4,305          | 4.05          | 5,473          | 13.21         | 18,755           | 17.23         | 4,449          | 19.78         | 2,508          | 18.17         | 3,516          | 3.05          | 151           | 3.62          | 4.3E+11        | 23.09         |
|                                 | Cropland, Generic          | 1,320          | 1.24          | 9,699          | 23.41         | 18,359           | 16.87         | 5,262          | 23.40         | 1,683          | 12.19         | 1,143          | 0.99          | 16            | 0.37          | 1.9E+11        | 10.15         |
|                                 | Cropland, Row Crops        | 1,877          | 1.76          | 17,304         | 41.76         | 31,050           | 28.53         | 6,711          | 29.84         | 4,946          | 35.83         | 2,404          | 2.08          | 71            | 1.71          | 1.3E+11        | 6.90          |
|                                 | Urban/Recreational Grass   | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Forest, Deciduous          | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Forest, Mixed              | 2,348          | 2.21          | 21             | 0.05          | 64               | 0.06          | 8              | 0.04          | 7              | 0.05          | 241            | 0.21          | 3             | 0.08          | 6.6E+07        | 0.00          |
|                                 | Pasture, Managed           | 13,681         | 12.86         | 918            | 2.21          | 4,774            | 4.39          | 836            | 3.71          | 2,115          | 15.33         | 38,465         | 33.35         | 2,389         | 57.32         | 1.4E+11        | 7.52          |
|                                 | Rangeland, Brushv          | 3,522          | 3.31          | 360            | 0.87          | 1,783            | 1.64          | 243            | 1.08          | 137            | 0.99          | 2,281          | 1.98          | 69            | 1.65          | 2.8E+10        | 1.52          |
|                                 | Rangeland                  | 78,970         | 74.25         | 7,595          | 18.33         | 33,735           | 31.00         | 4,924          | 21.89         | 2,391          | 17.33         | 67,073         | 58.15         | 1,467         | 35.20         | 9.4E+11        | 50.80         |
|                                 | Urban, Comm./Ind./Trans.   | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Urban, High Dens. Resid.   | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Urban, Low Dens. Resid.    | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Urban, Medium Dens. Resid. | 0              | 0.00          | ---            | ---           | ---              | ---           | ---            | ---           | ---            | ---           | ---            | ---           | ---           | ---           | ---            | ---           |
|                                 | Wetland, Herbaceous        | 338            | 0.32          | 63             | 0.15          | 306              | 0.28          | 58             | 0.26          | 15             | 0.11          | 225            | 0.19          | 2             | 0.05          | 6.0E+07        | 0.00          |
| <b>Basin Total and Averages</b> |                            | <b>106,361</b> | <b>100.00</b> | <b>41,432</b>  | <b>100.00</b> | <b>108,826</b>   | <b>100.00</b> | <b>22,491</b>  | <b>100.00</b> | <b>13,802</b>  | <b>100.00</b> | <b>115,348</b> | <b>100.00</b> | <b>4,168</b>  | <b>100.00</b> | <b>1.8E+12</b> | <b>100.00</b> |

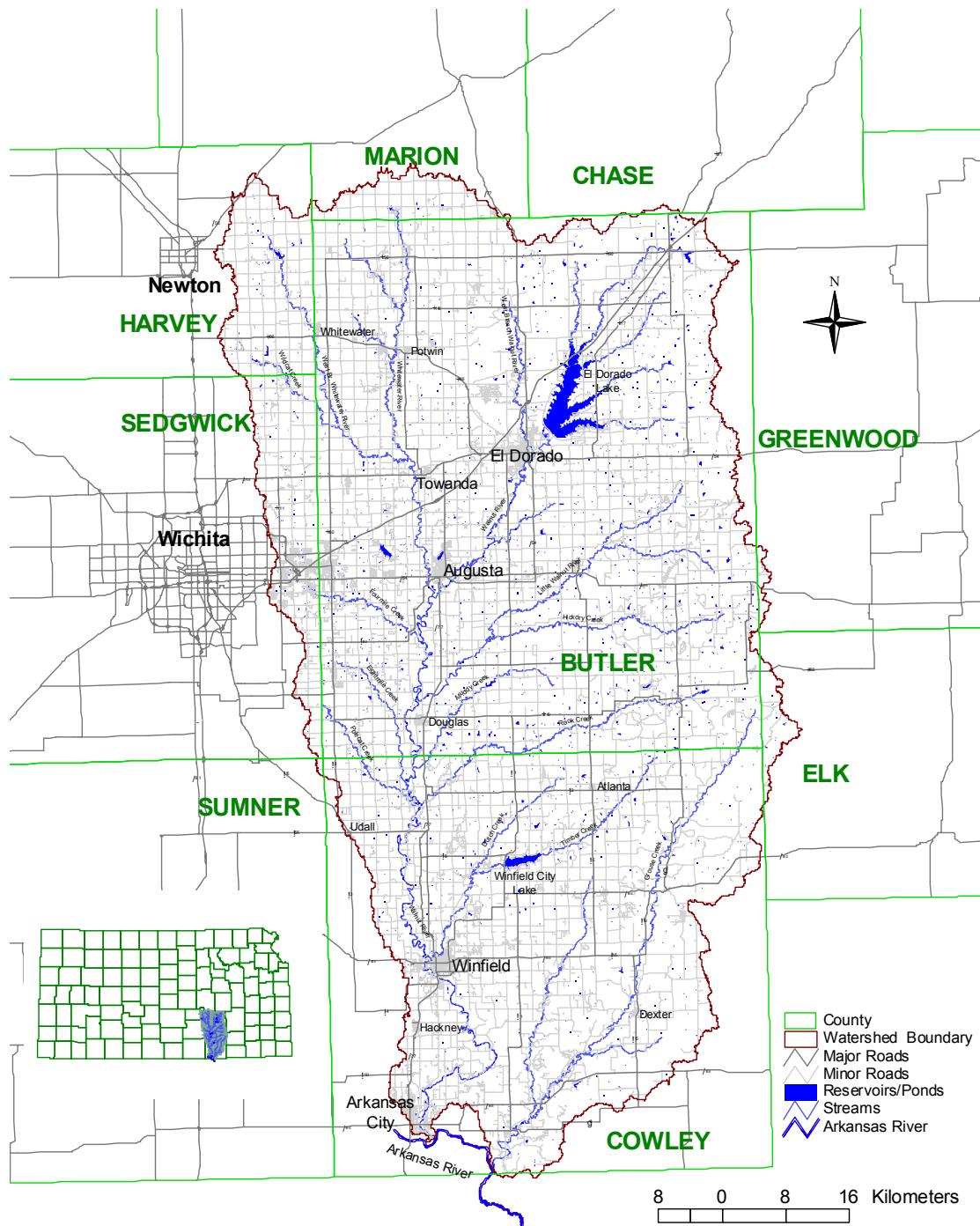
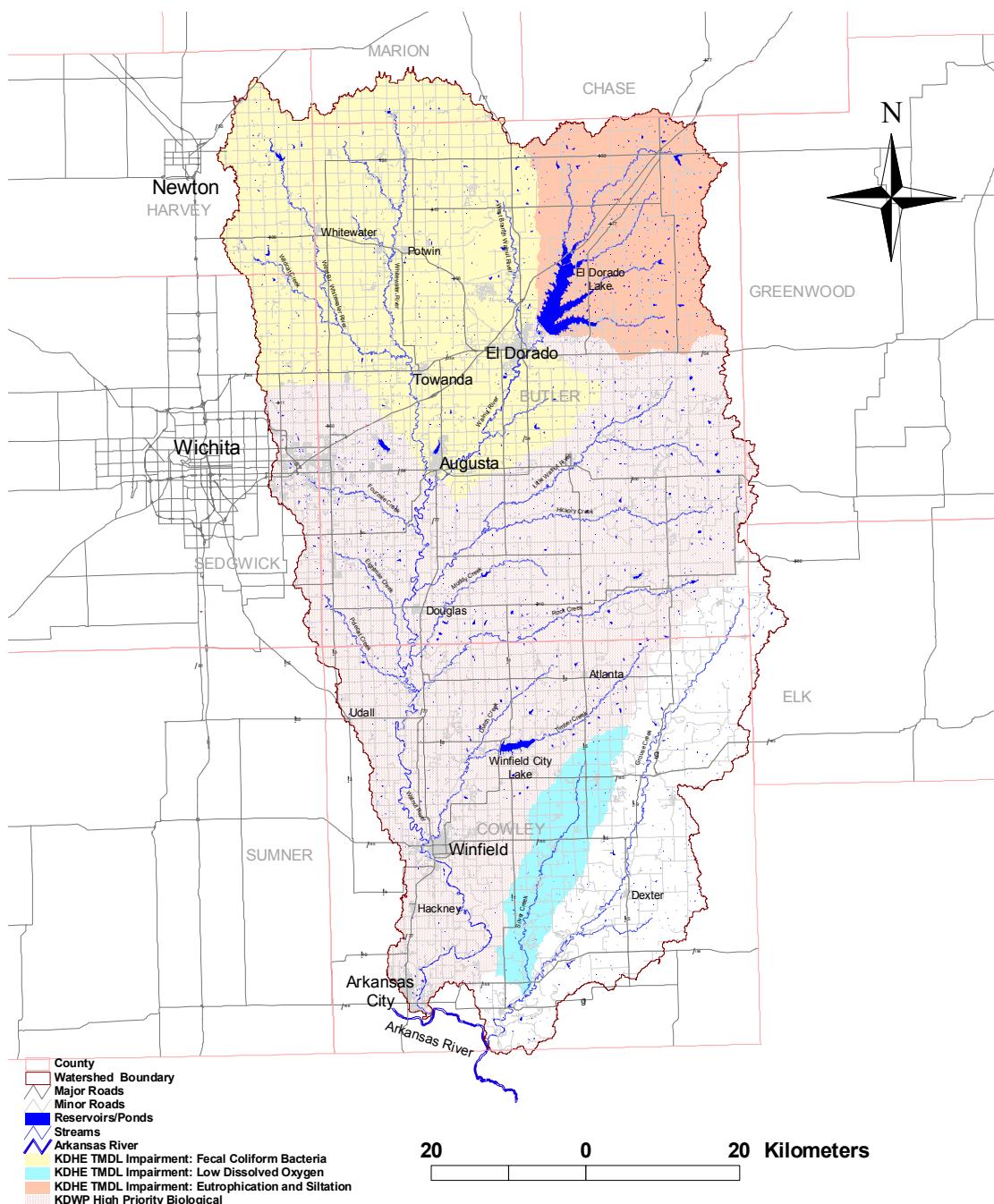
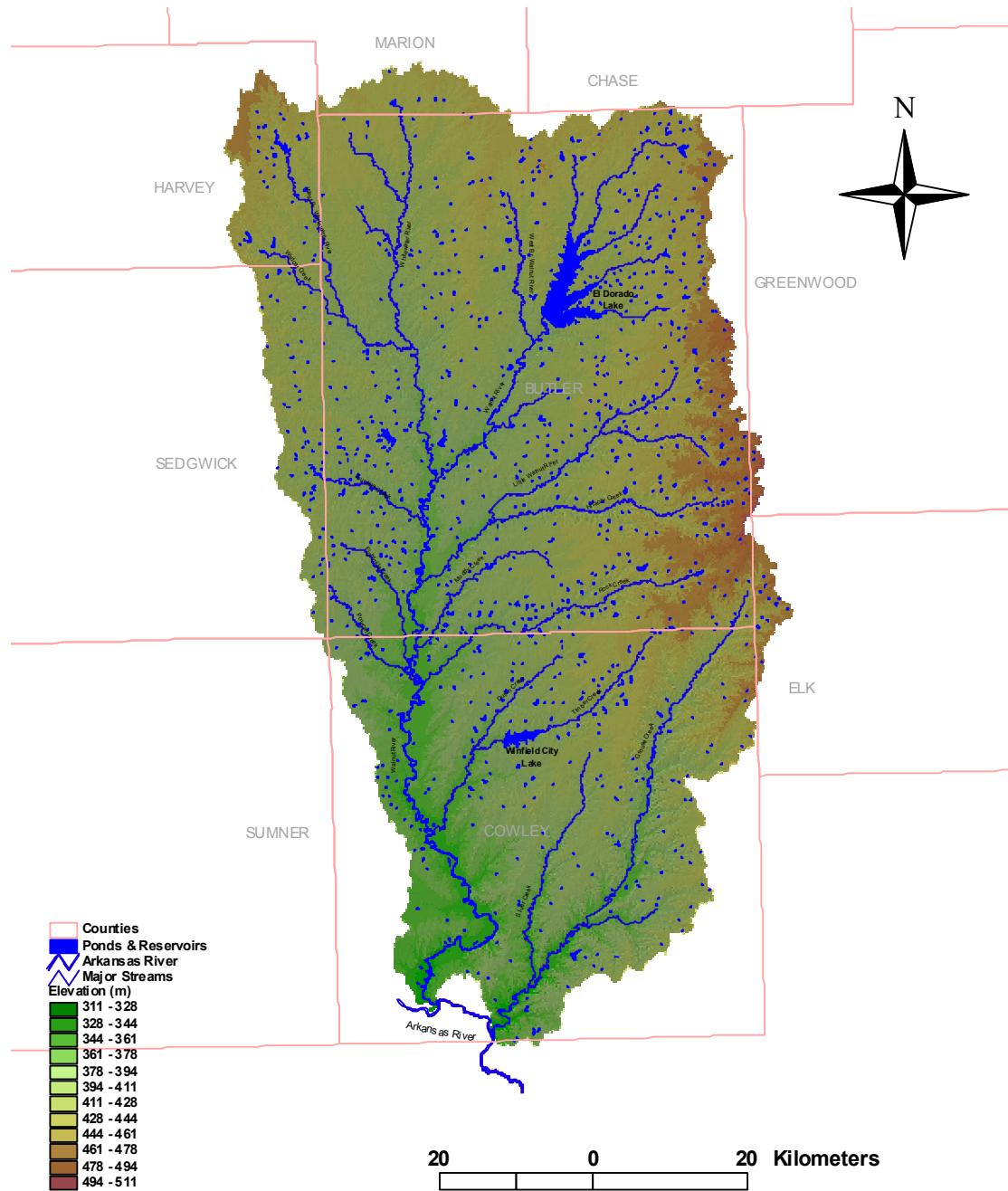


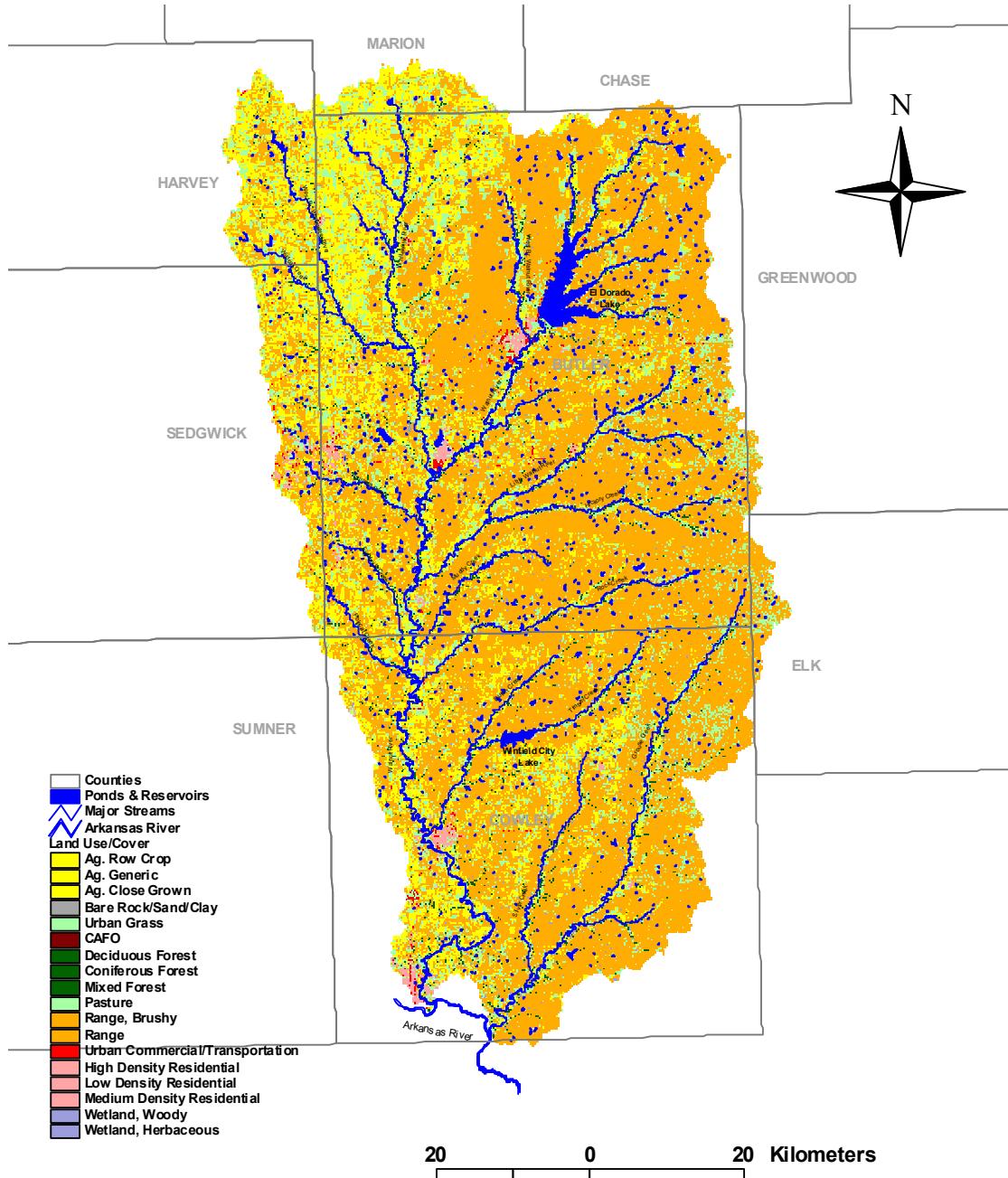
Figure 1. Location of the Walnut River/Grouse Creek Watershed in Kansas.



**Figure 2.** Locations of KDHE High Priority TMLD, and KDWP High Biological Priority areas in the Walnut River Grouse Creek Watershed. KDWP High Priority Biological area extends into the upper portion of the Walnut Watershed and coincides with TMDL areas.

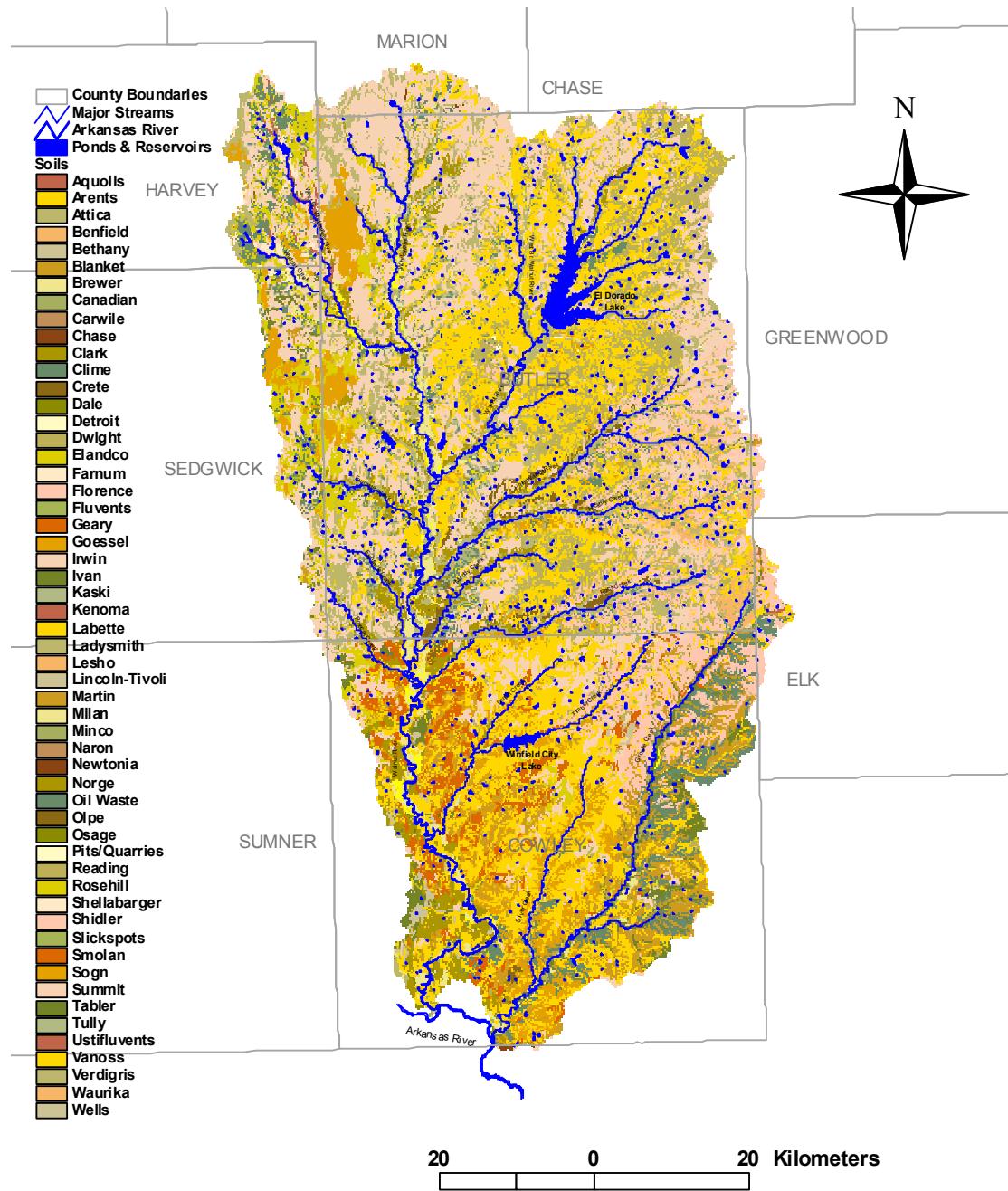


**Figure 3.** Elevation in meters above sea level for the Walnut River/Grouse Creek Watershed derived from USGS (2000) NED data.



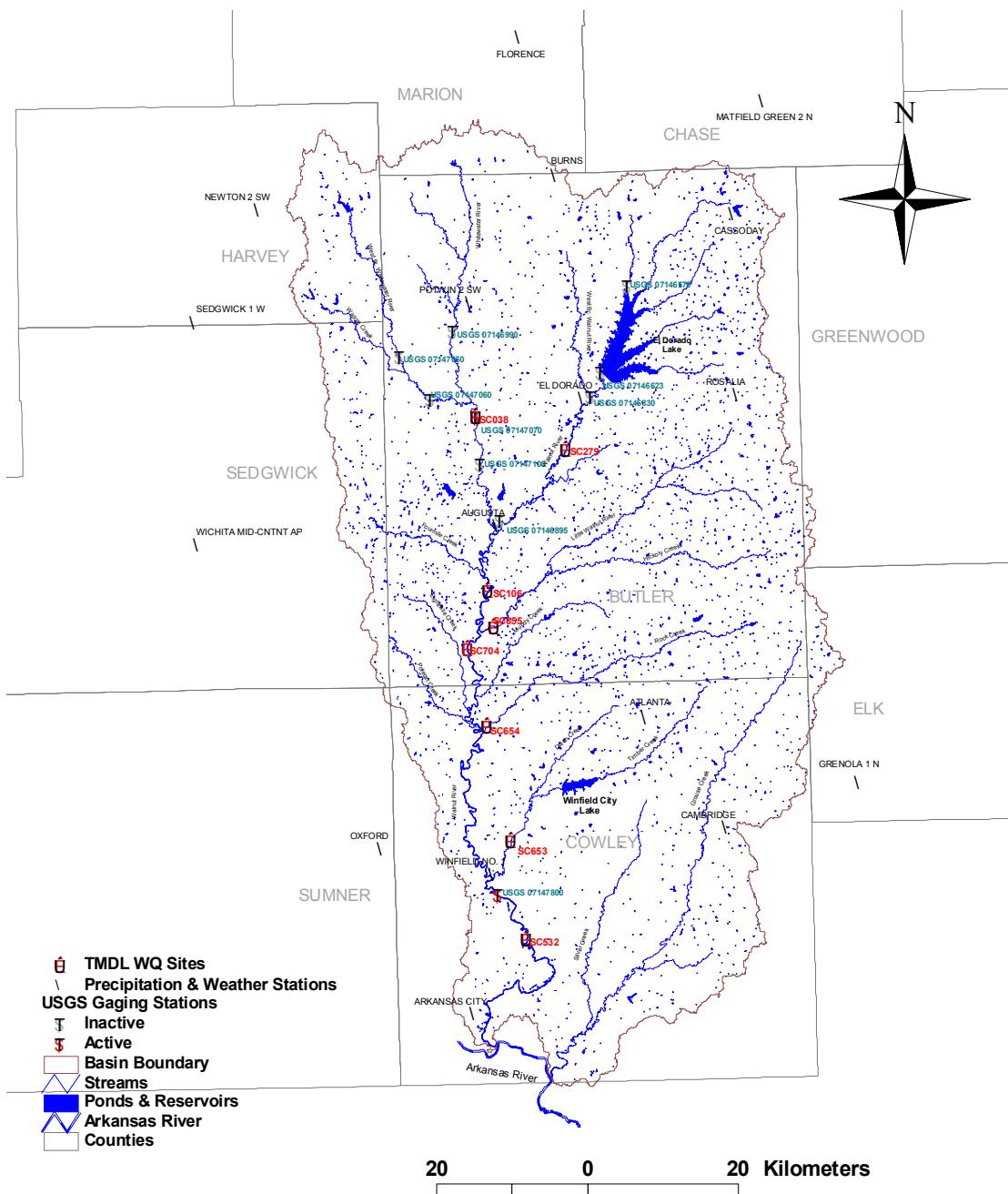
-County boundaries from TIGER, 2000  
 -Reservoirs/Ponds from USGS NLCD, 2000  
 -Streams and watershed boundary developed from USGS NED, 2000  
 -Land Use from USGS NLCD, 2000 and USDA-NRCS, 2001

**Figure 4.** Land use/cover in the Walnut River/Grouse Creek Watershed derived from USGS (2002a) NLCD and USDA-NRCS (2001) Riparian data for Kansas.

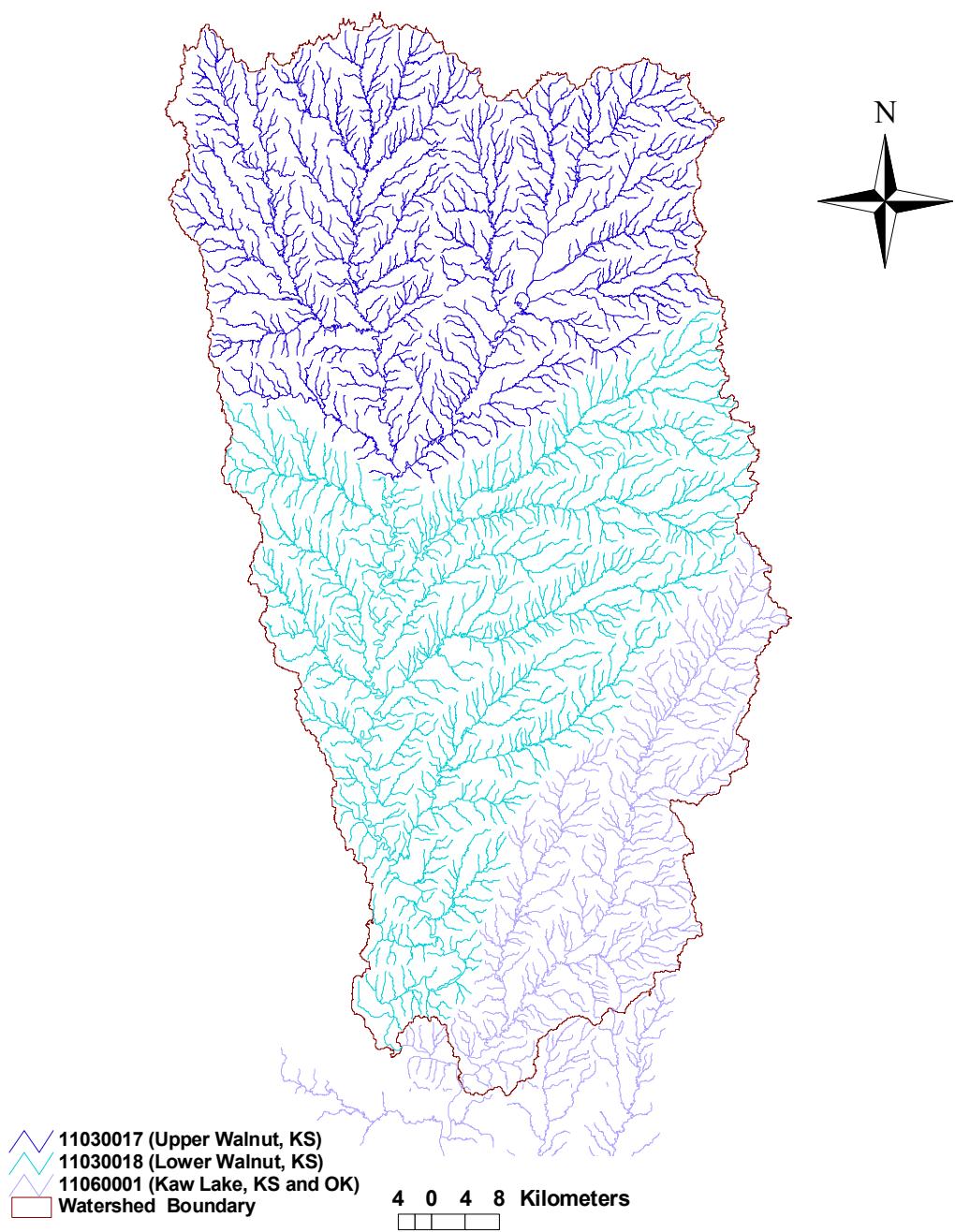


County boundaries from TIGER, 2000  
 Reservoirs/Ponds from USGS NLCD, 2000  
 Streams and watershed boundary developed from USGS NED, 2000  
 Soils from NRCS SSURGO, 2000

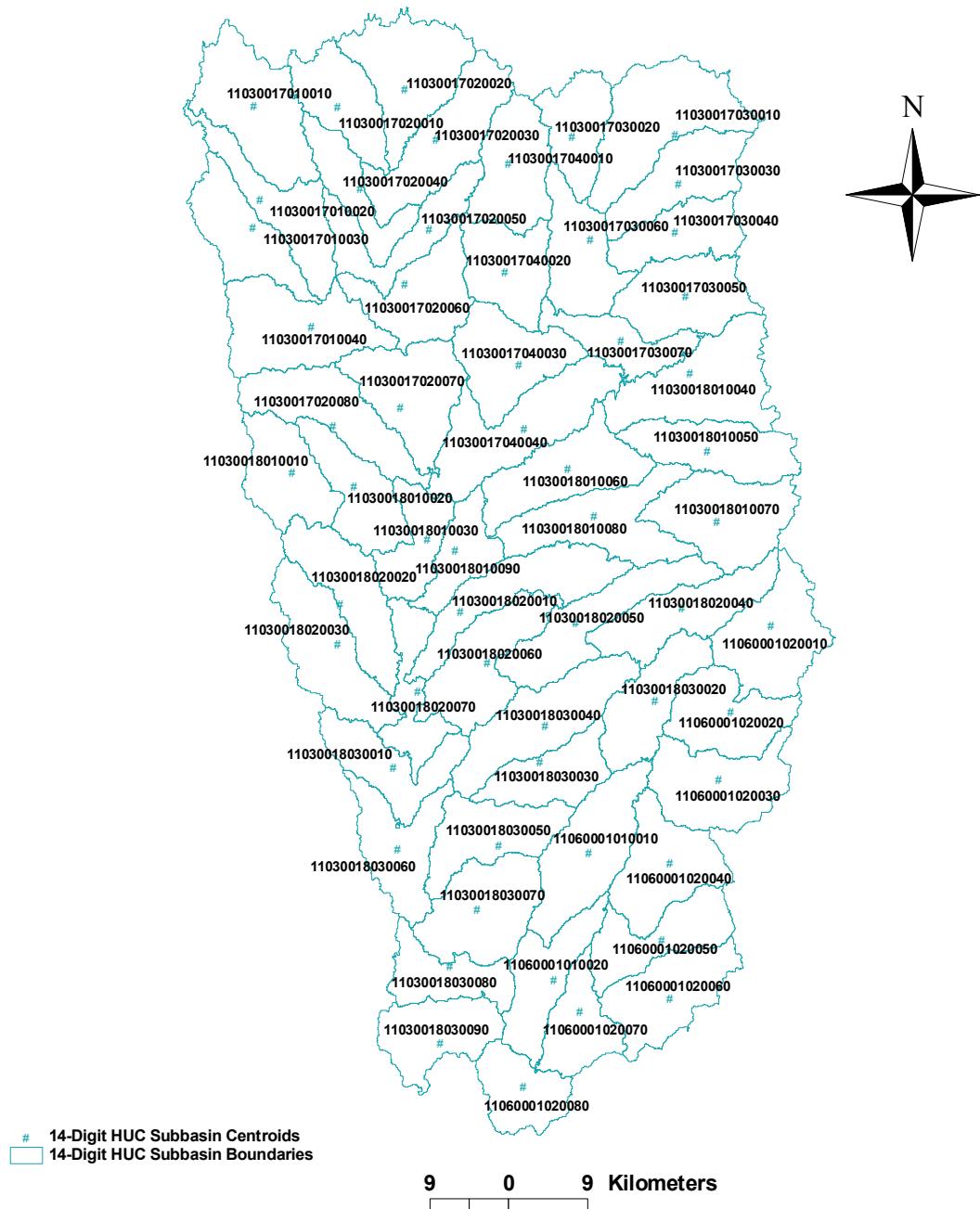
**Figure 5. Walnut River/Grouse Creek Watershed soils derived from USDA-NRCS (1998) SSURGO data identified by dominant soil name.**



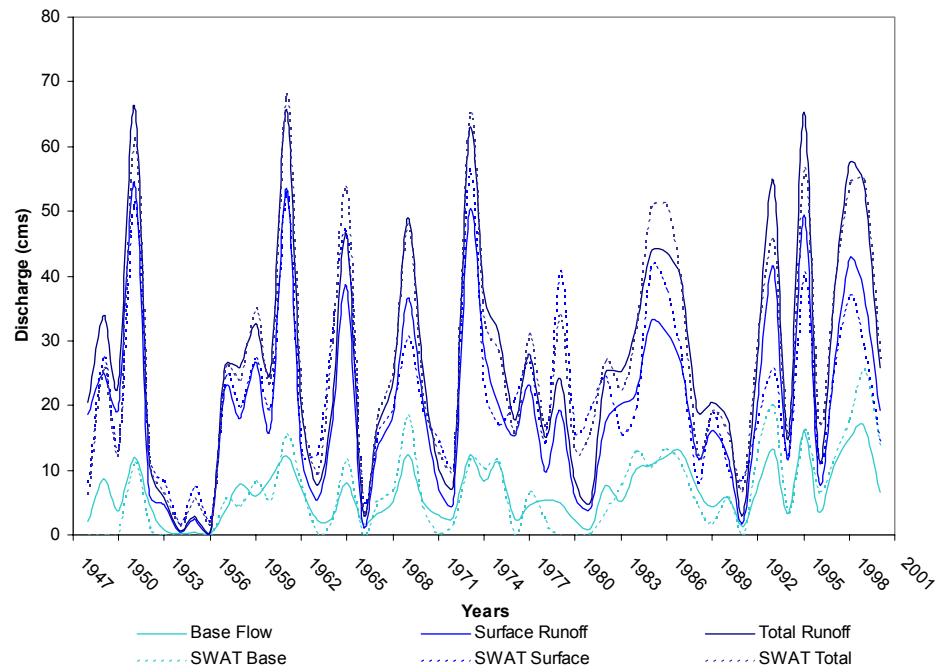
**Figure 6.** USGS gaging station, weather station, and KDHE TMDL water quality site locations in and around the Walnut River/Grouse Creek Watershed.



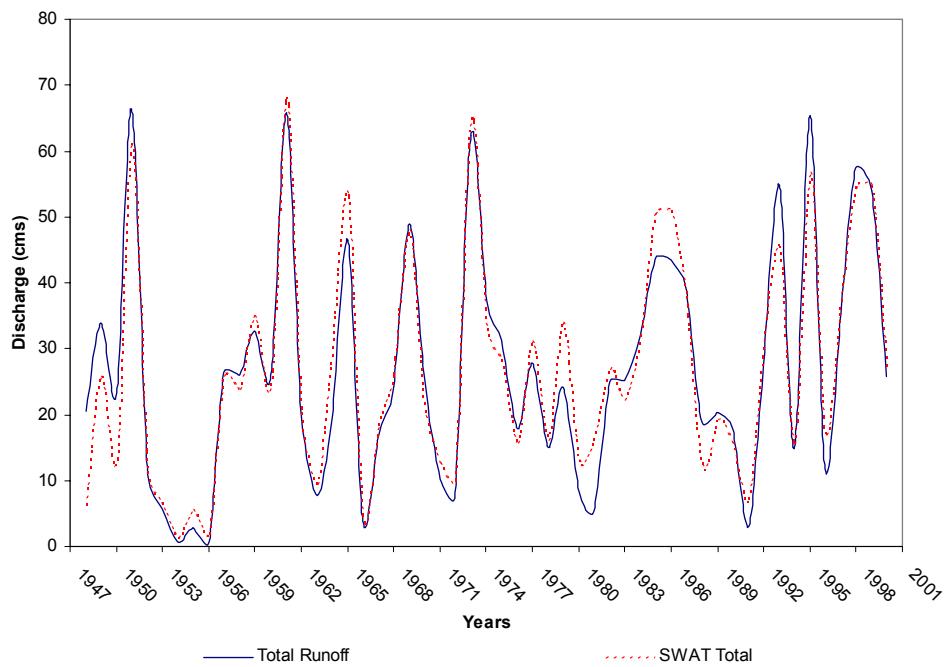
**Figure 7.** USGS National Hydrography Dataset (USGS, 1999b) eight-digit HUCs encompassing the Walnut River/Grouse Creek Watershed.



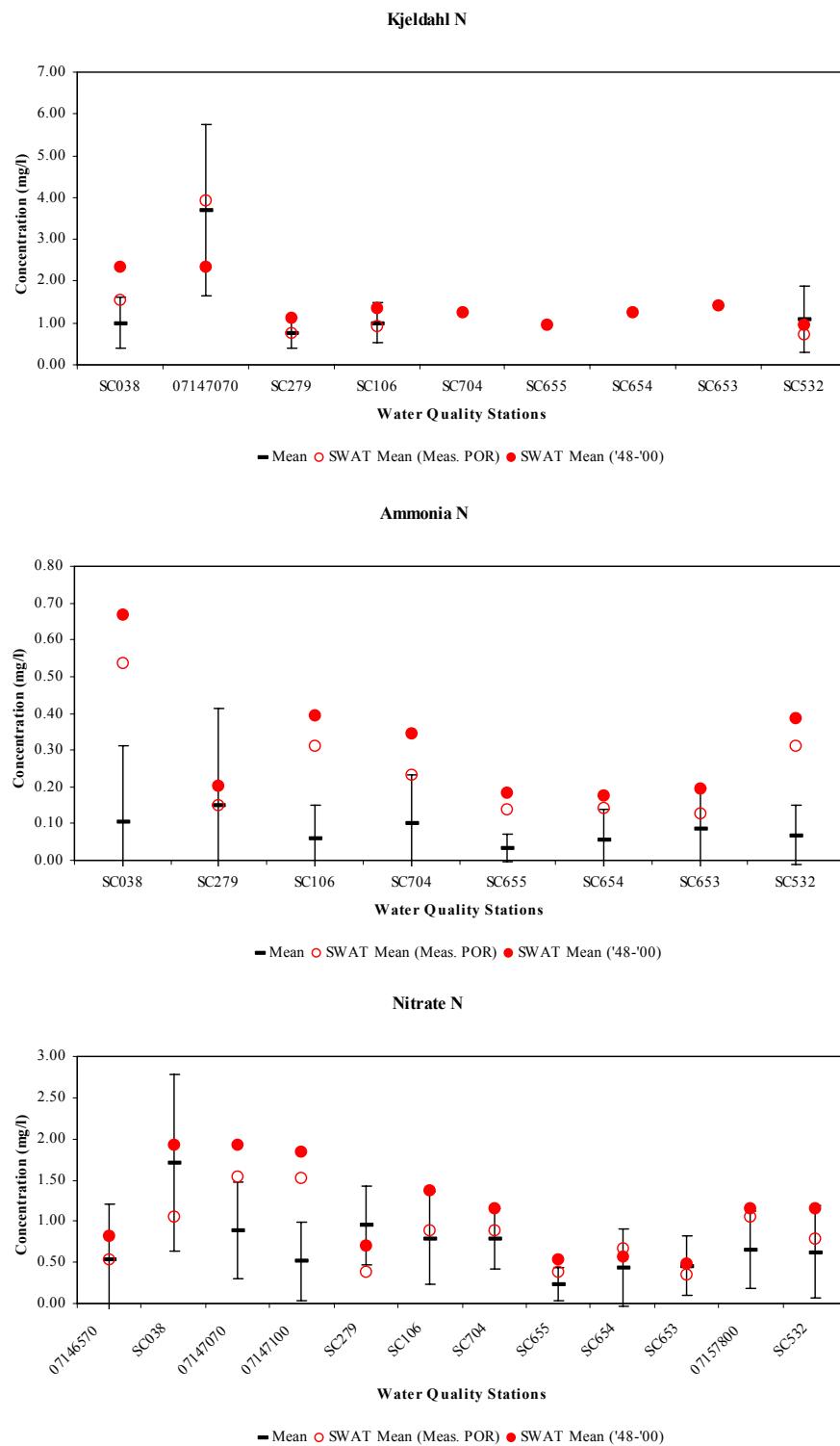
**Figure 8.** Subbasins in the Walnut River/Grouse Creek Watershed identified by 14-digit HUCs.



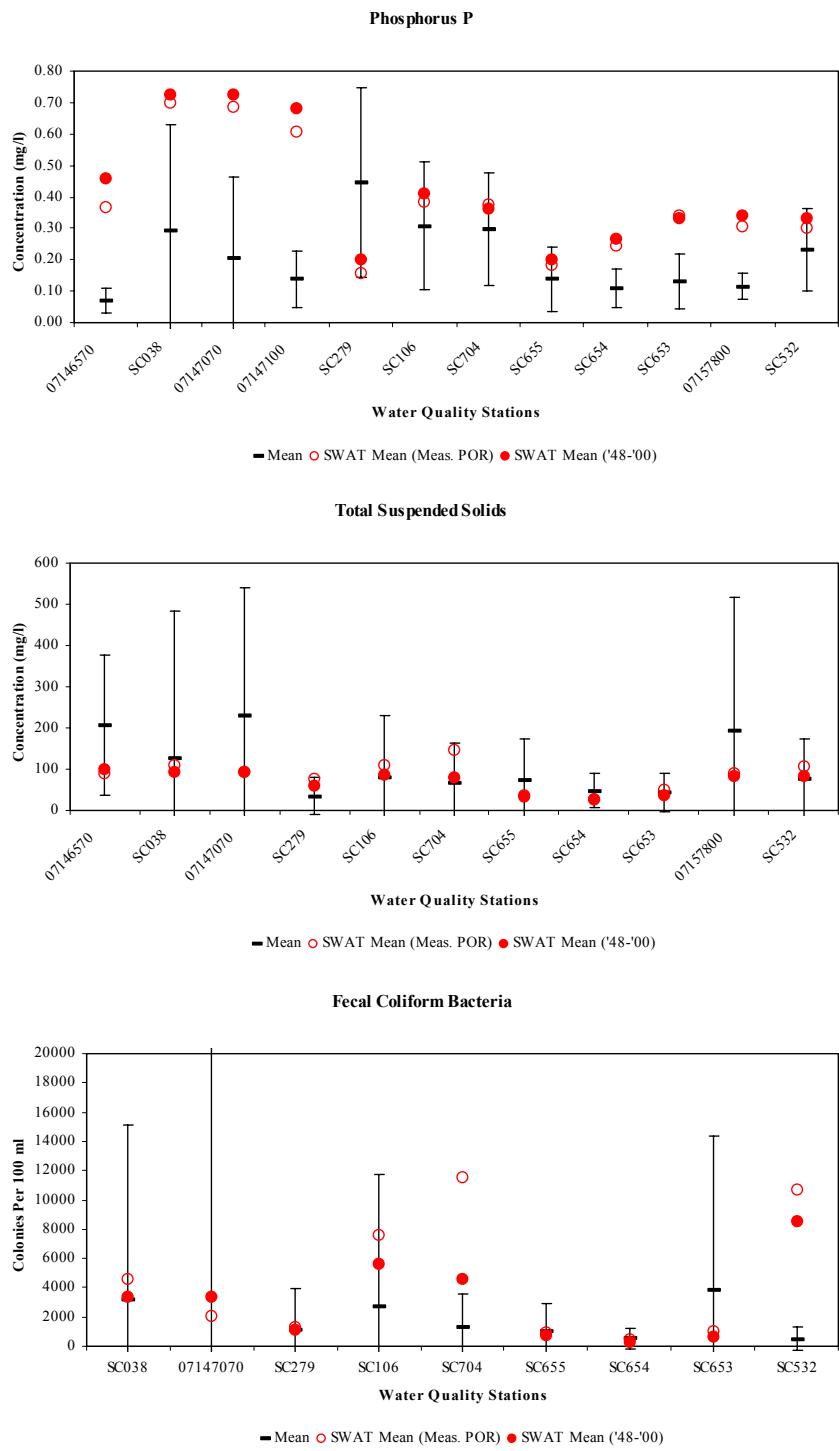
**Figure 9.** Comparison of measured and simulated mean annual base, surface, and total discharge at USGS 07147800.



**Figure 10.** Comparison of measured and simulated mean annual discharge at USGS 07147800.

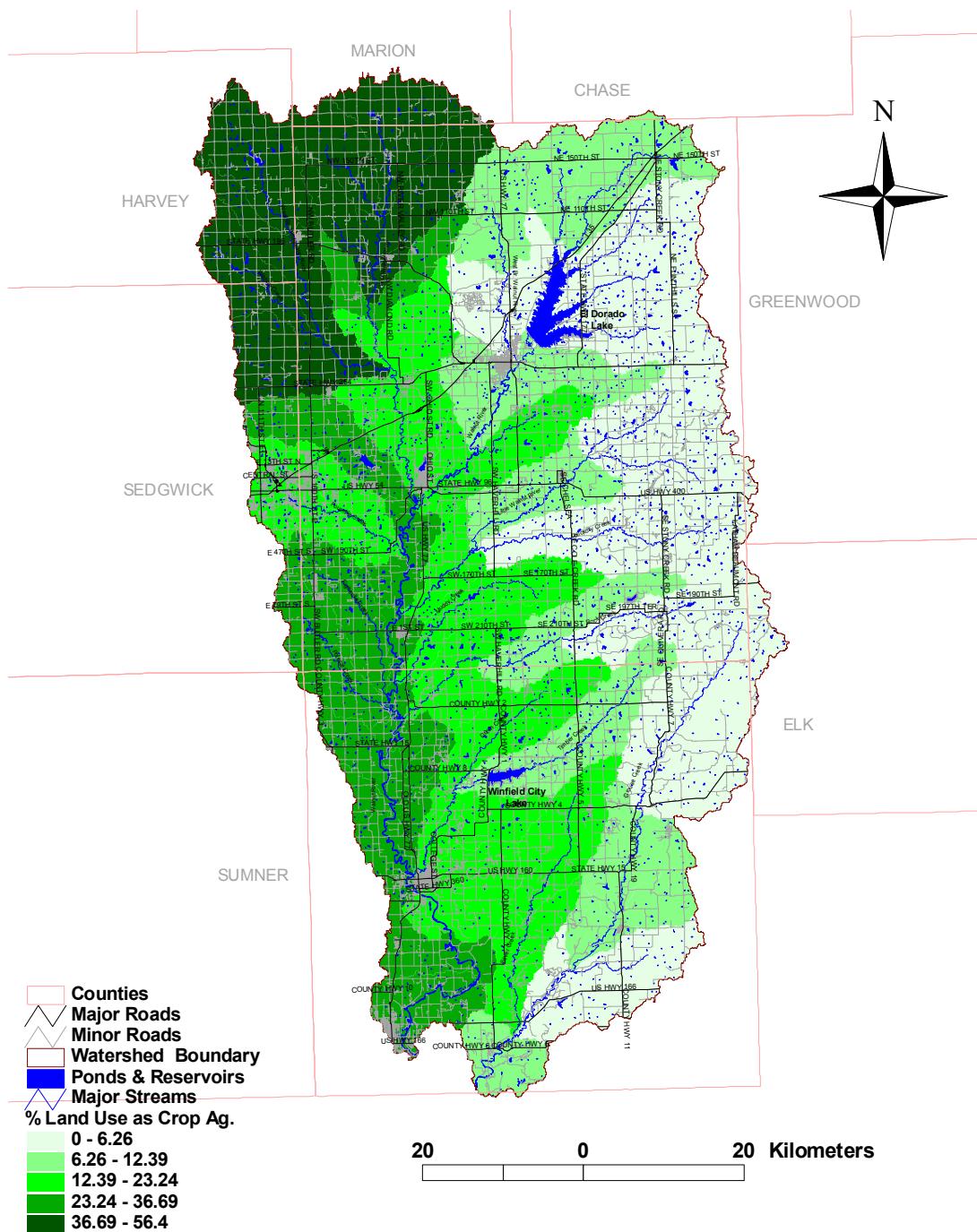


**Figure 11.** Comparison of modeled and measured nitrogen forms at KDHE TMDL and USGS gage sites in the Walnut/Grouse Creek Watershed. Measured values are indicated by a black bar  $\pm 1$  SD. The red dots are model estimates. The open circle is the modeled mean for POR similar to measured mean, and the solid circle is the modeled mean for the full simulation period.

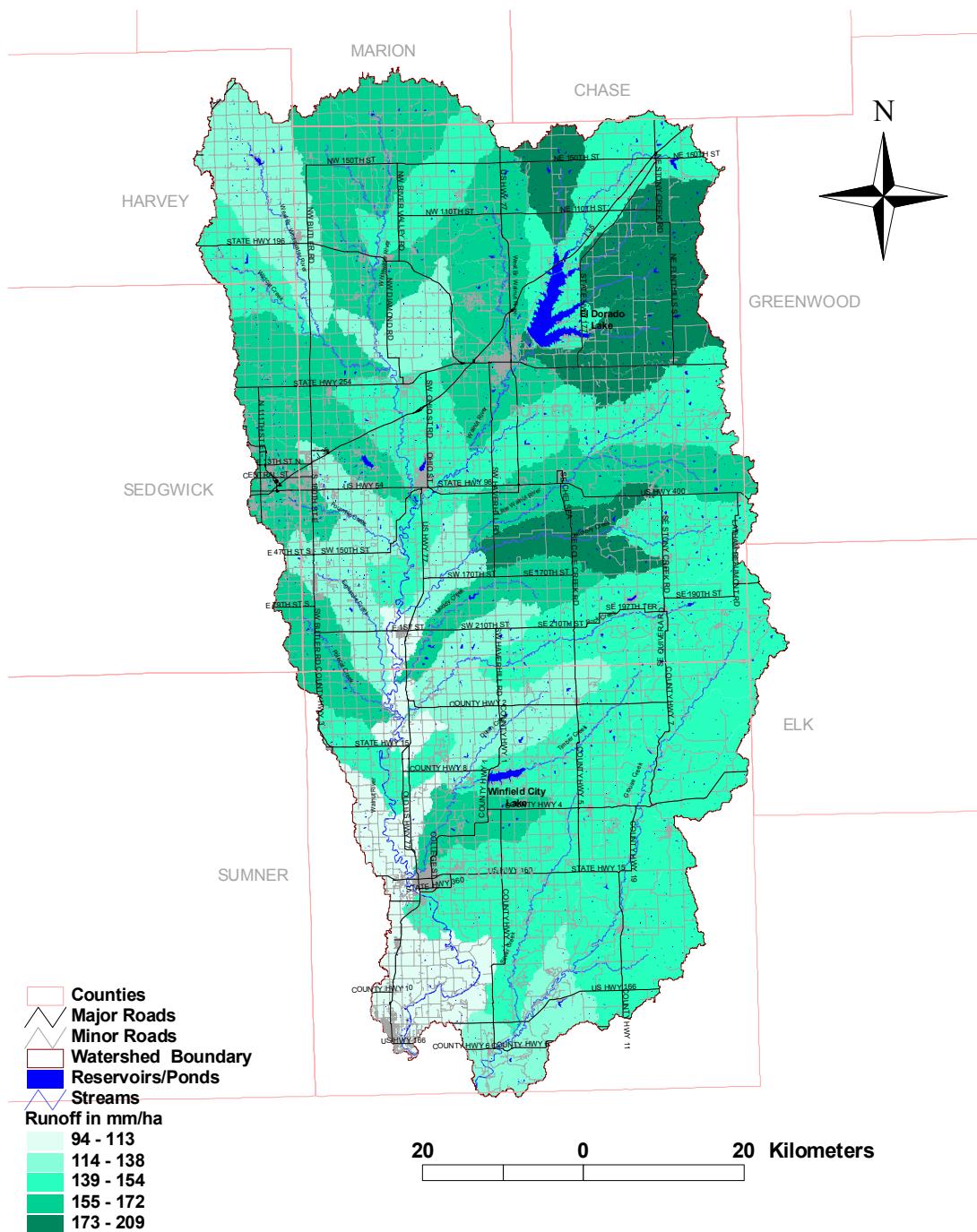


**Figure 12.**

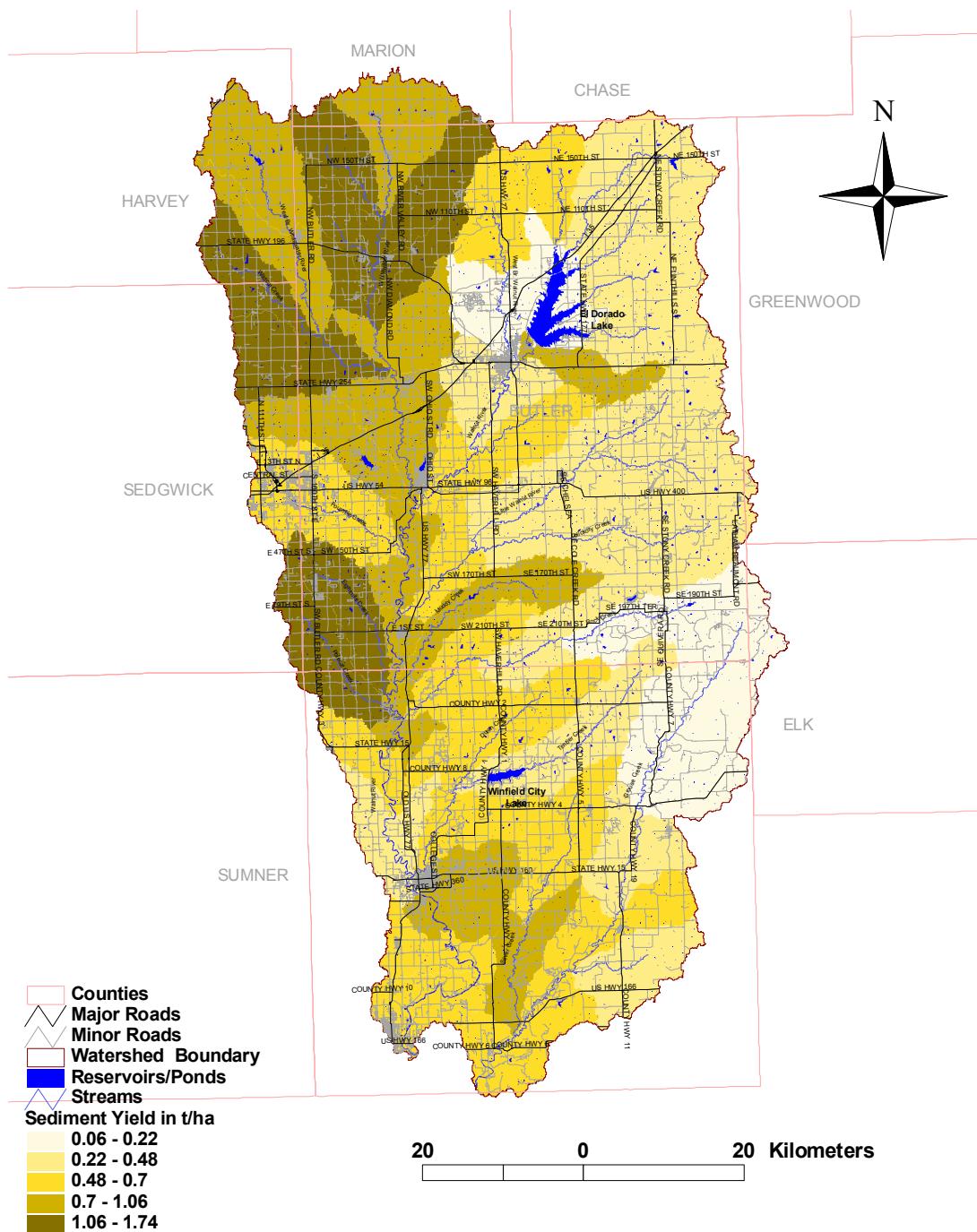
**Comparison of modeled and measured phosphorus, total suspended solids, and fecal coliform bacteria at KDHE TMDL and USGS gage sites in the Walnut/Grouse Creek Watershed. Measured values are indicated by a black bar  $\pm 1$  SD. The red dots are model estimates. The open circle is the modeled mean for POR similar to measured mean, and the solid circle is the modeled mean for the full simulation period.**



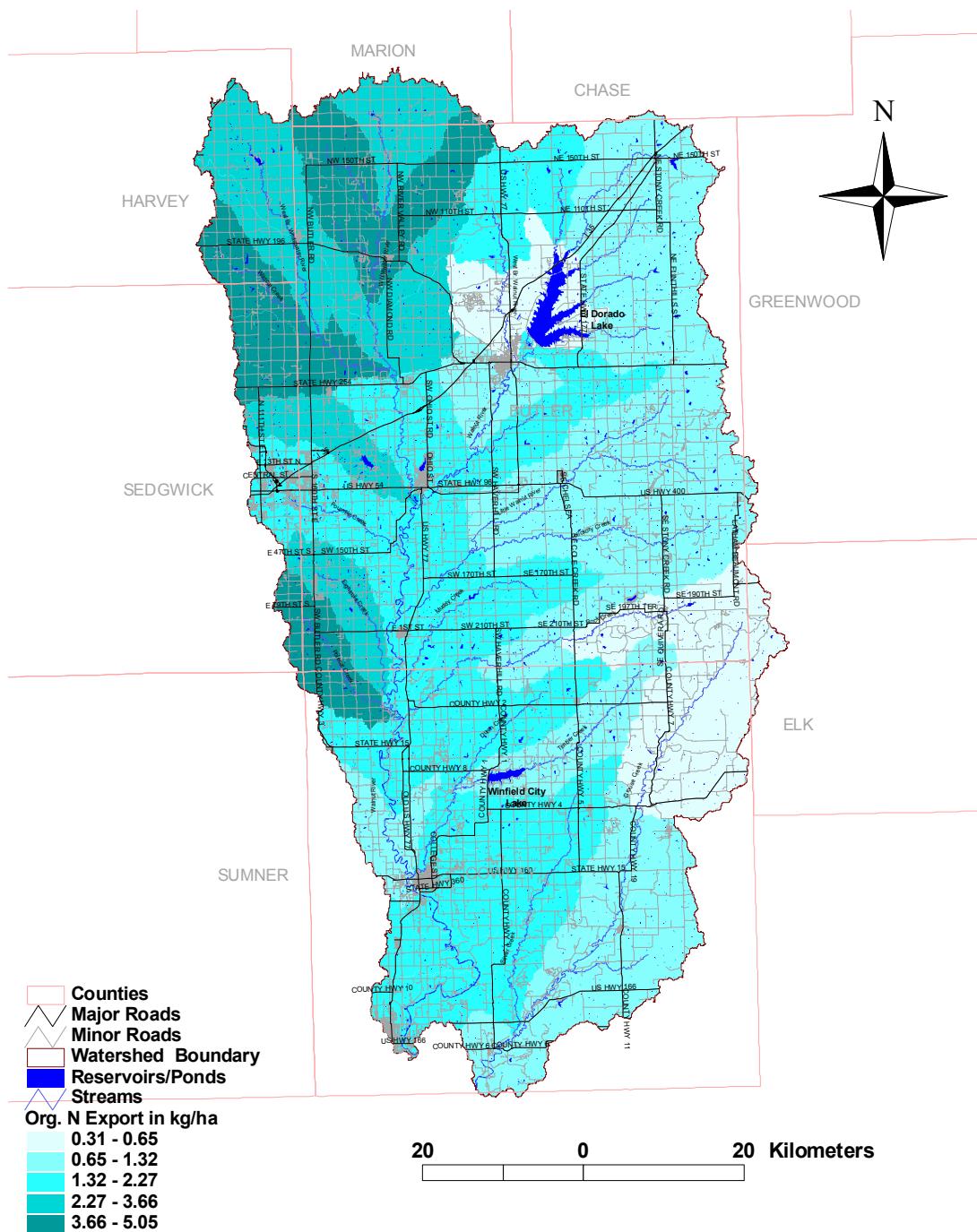
**Figure 13.** Percent of 14-Digit HUC area identified as cropland land use based on NLCD (USGS, 2000a) and Riparian Area Inventory (USDA-NRCS, 2001) data.



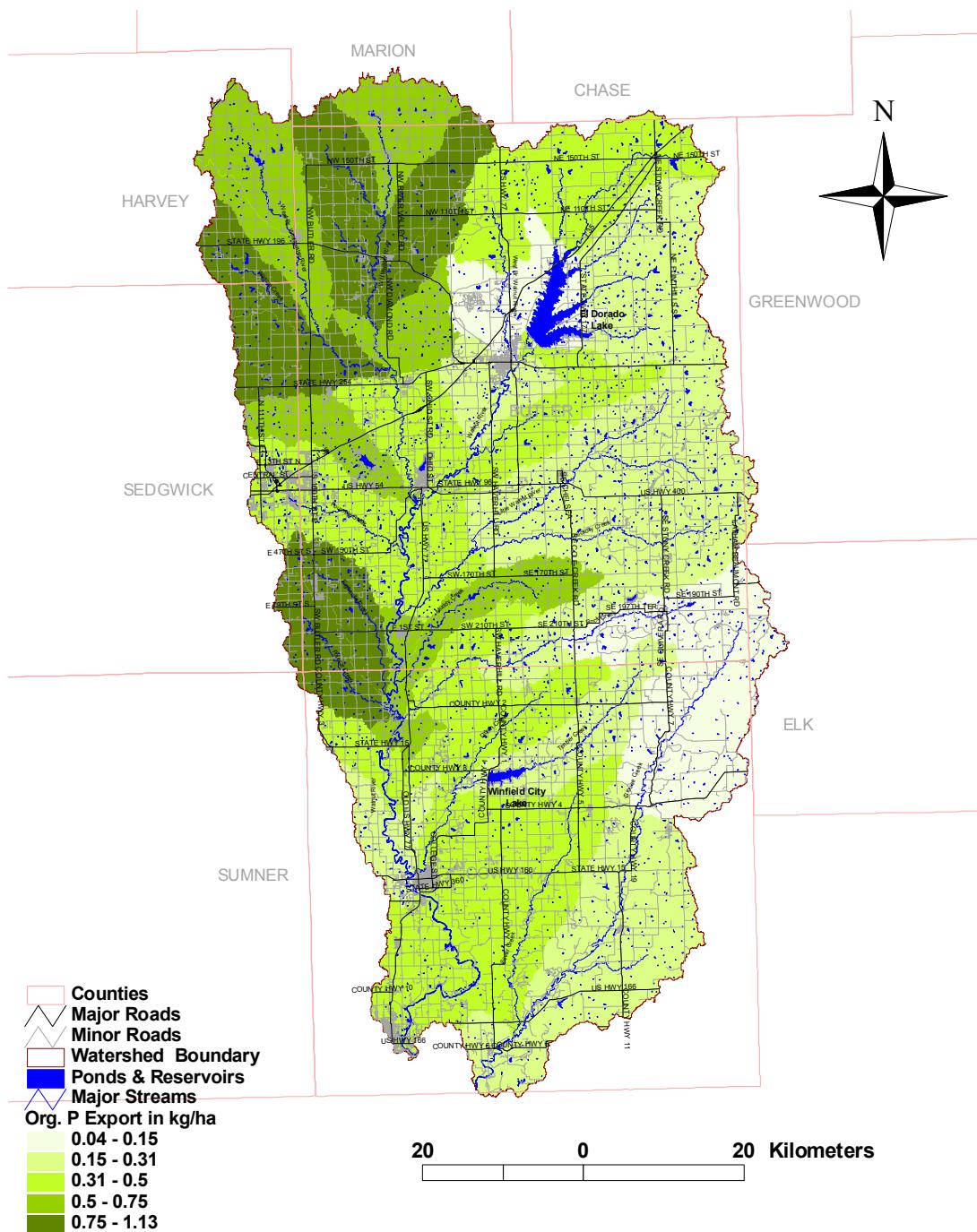
**Figure 14.** Simulated average annual surface runoff per hectare by 14-Digit HUC.



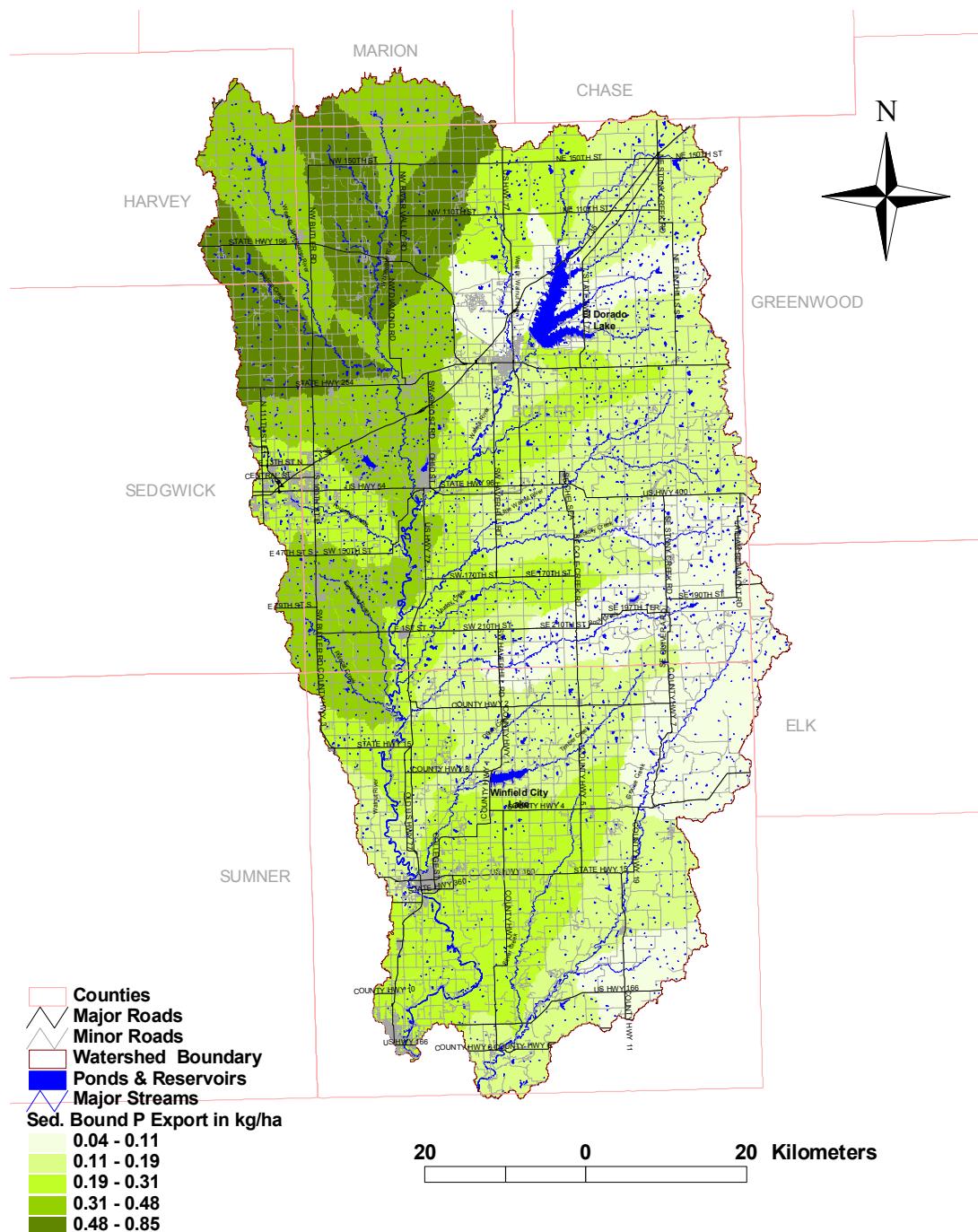
**Figure 15.** Simulated average annual sediment yield in metric tons per hectare by 14-Digit HUC.



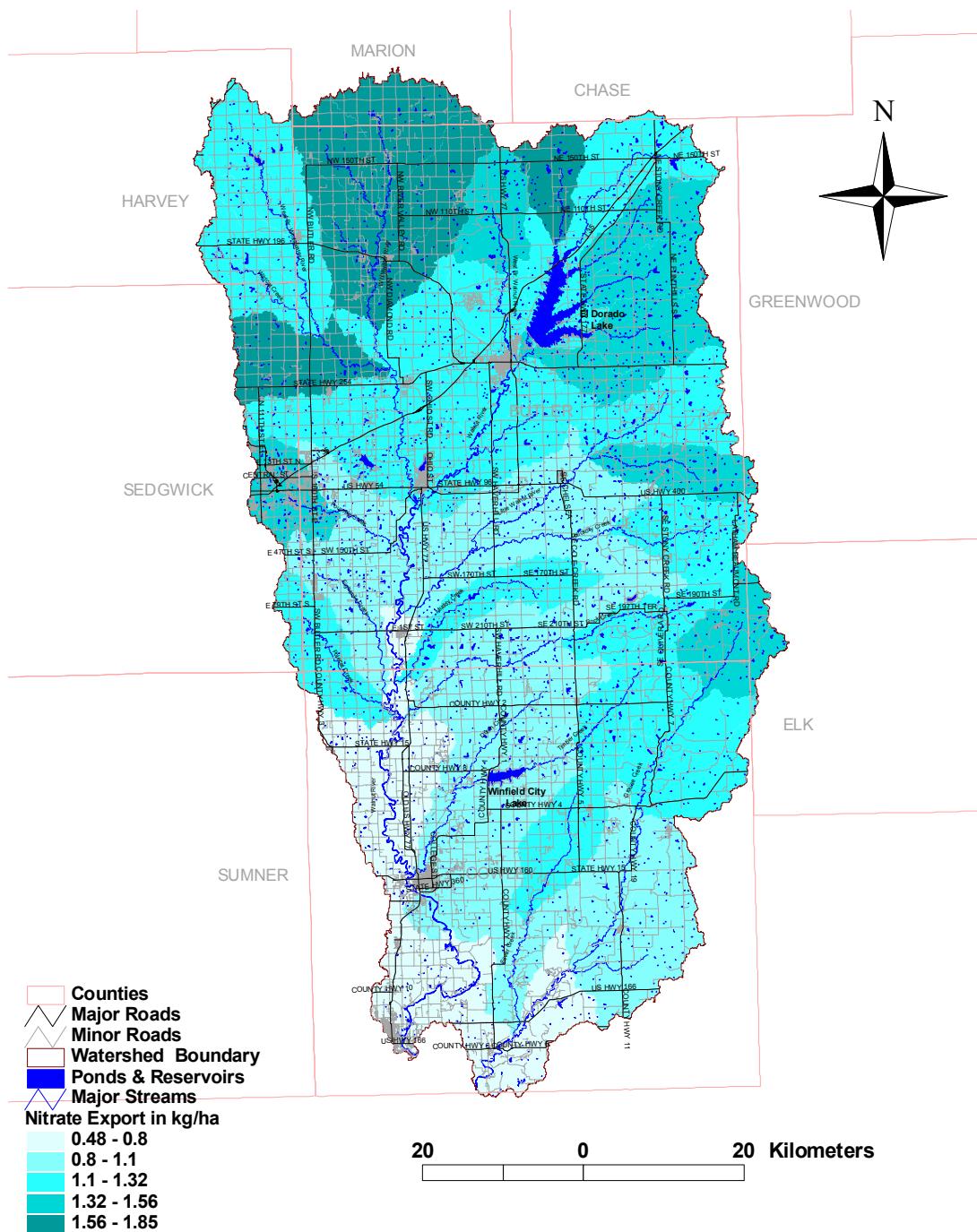
**Figure 16.** Simulated average annual organic nitrogen as N export in runoff per hectare by 14-Digit HUC.



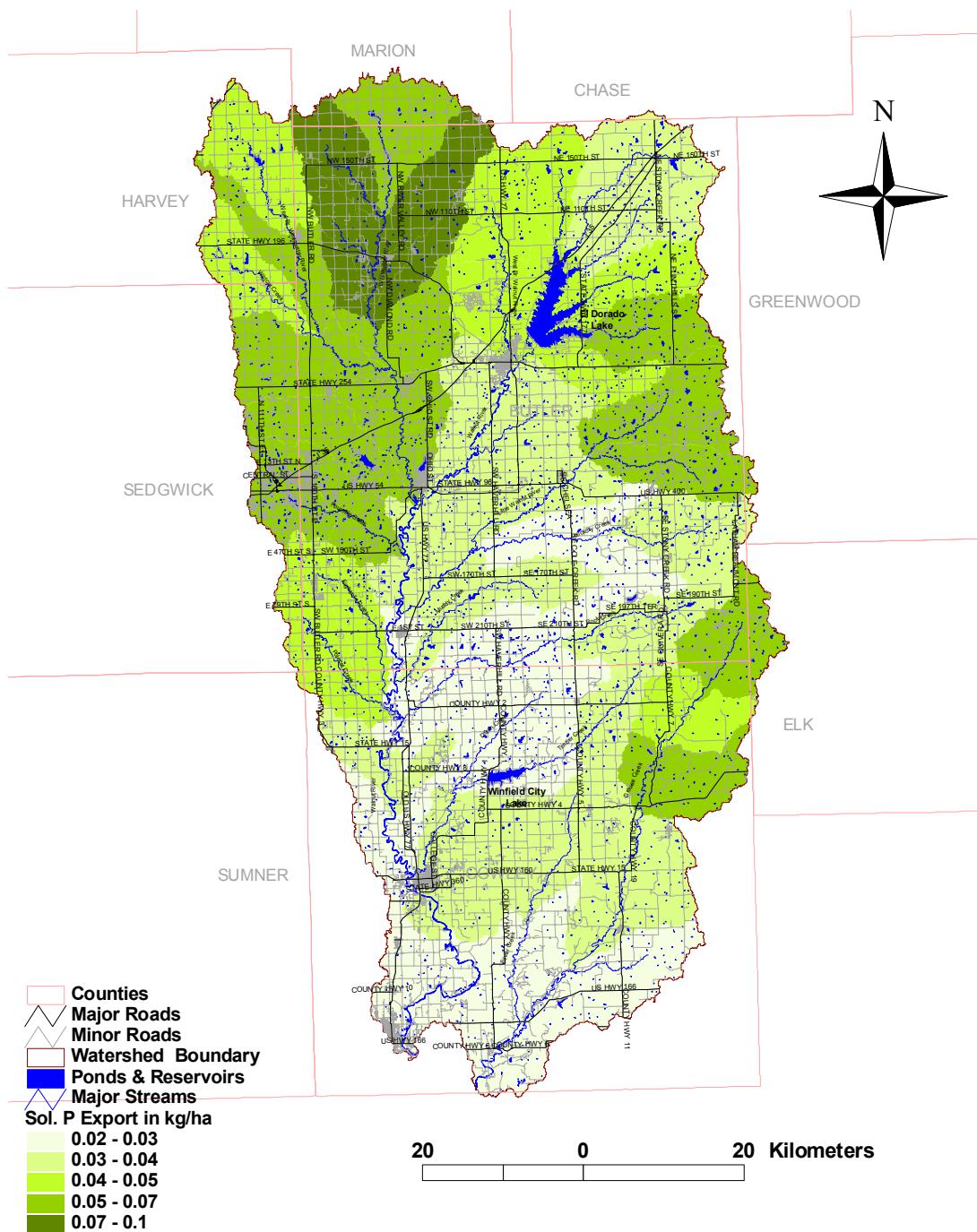
**Figure 17.** Simulated average annual organic phosphorus as P export in runoff per hectare by 14-Digit HUC.



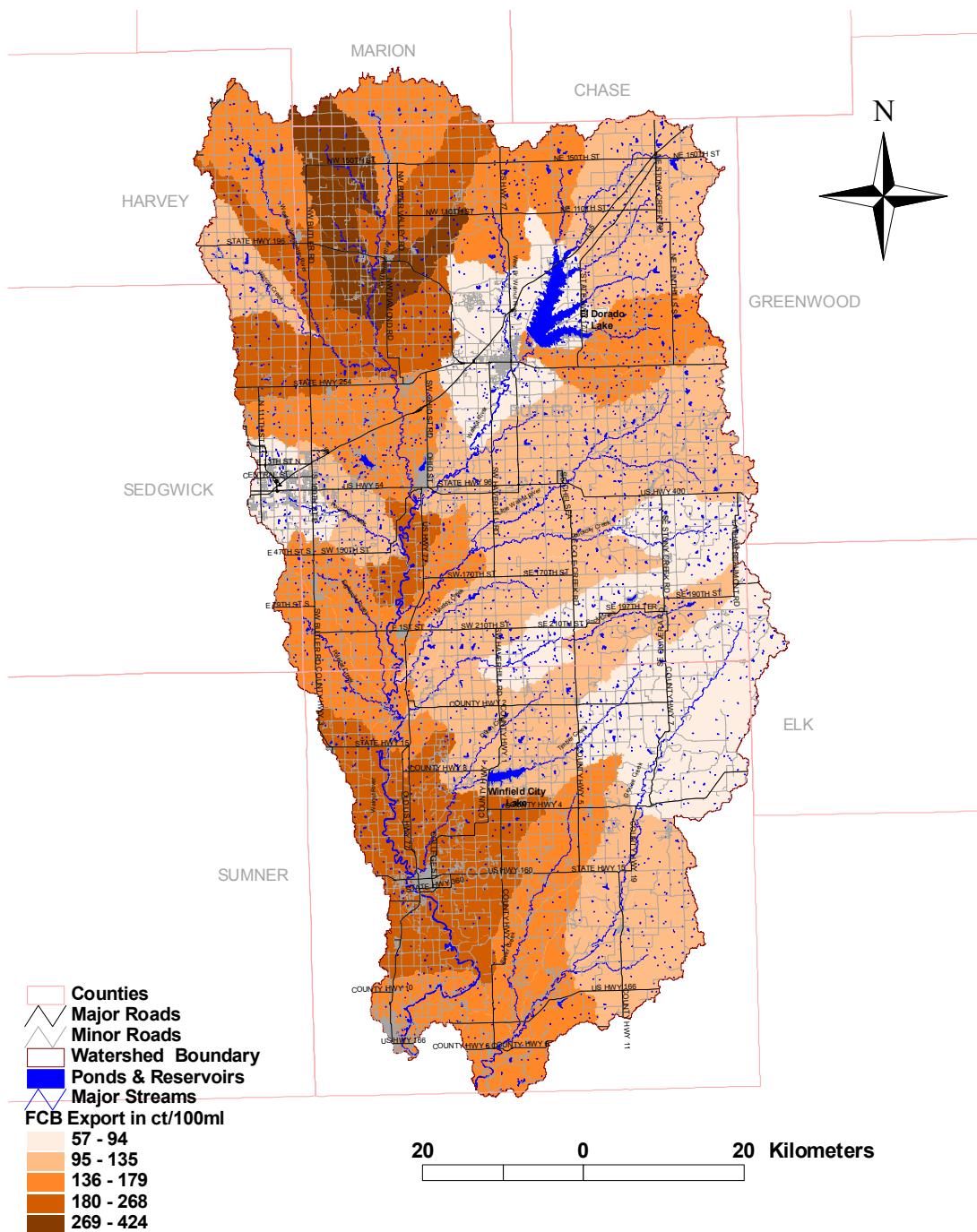
**Figure 18.** Simulated average annual sediment bound phosphorus as P export in runoff per hectare by 14-Digit HUC.



**Figure 19.** Simulated average annual nitrate as N export in runoff per hectare by 14-Digit HUC.



**Figure 20.** Simulated average annual soluble phosphorus as P export in runoff per hectare by 14-Digit HUC.



**Figure 21.** Simulated average Fecal Coliform Bacteria export in runoff as count per 100ml by 14-Digit HUC.

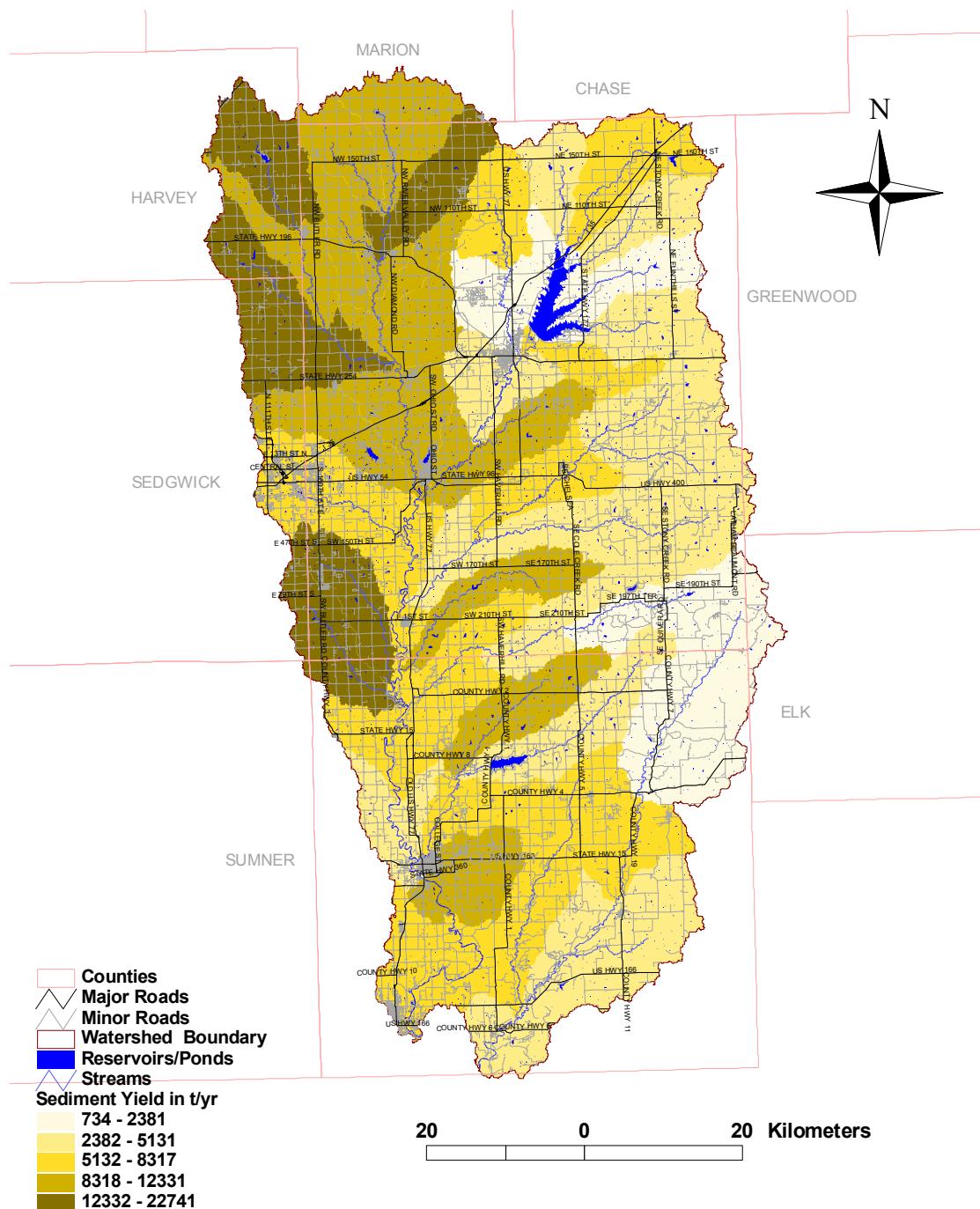
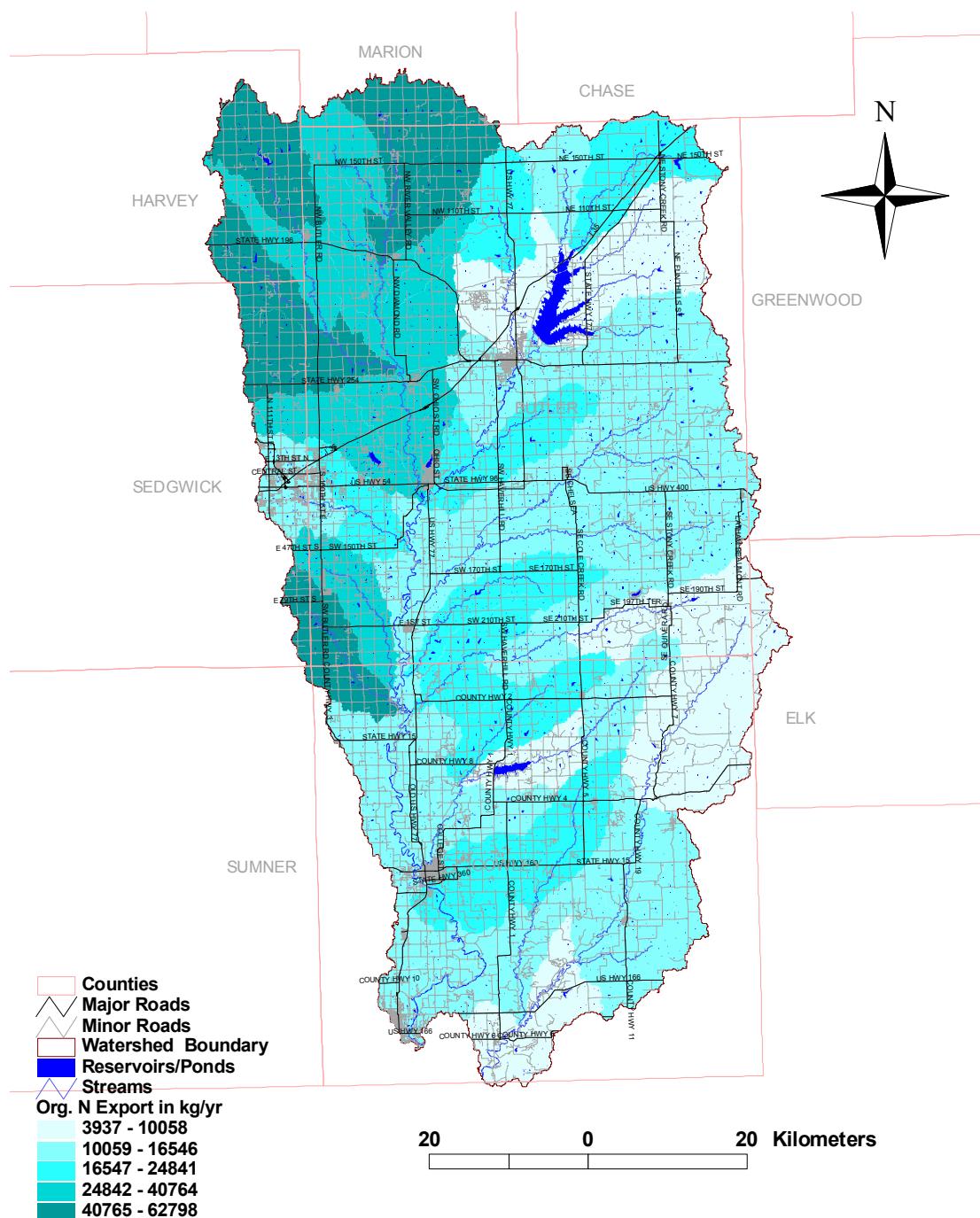
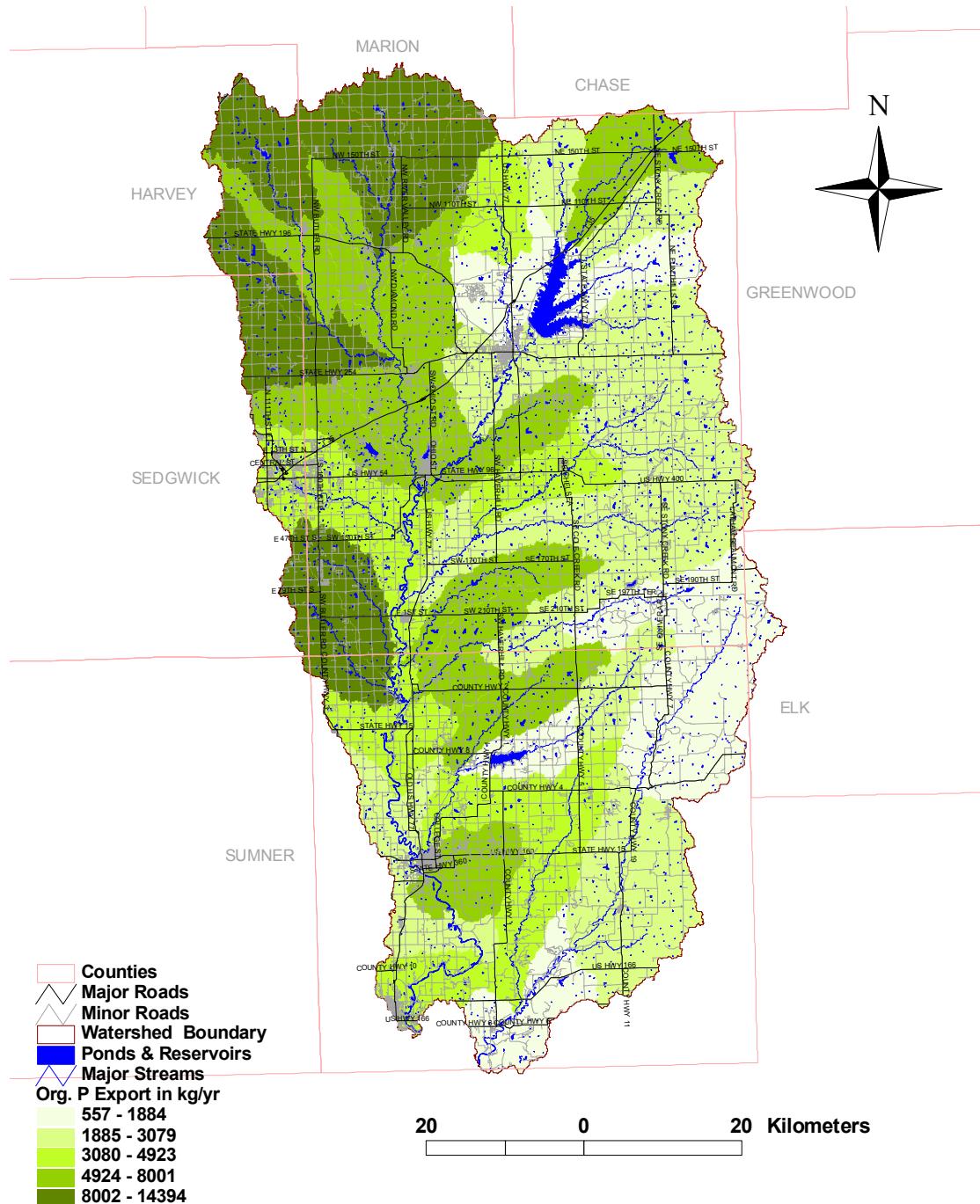


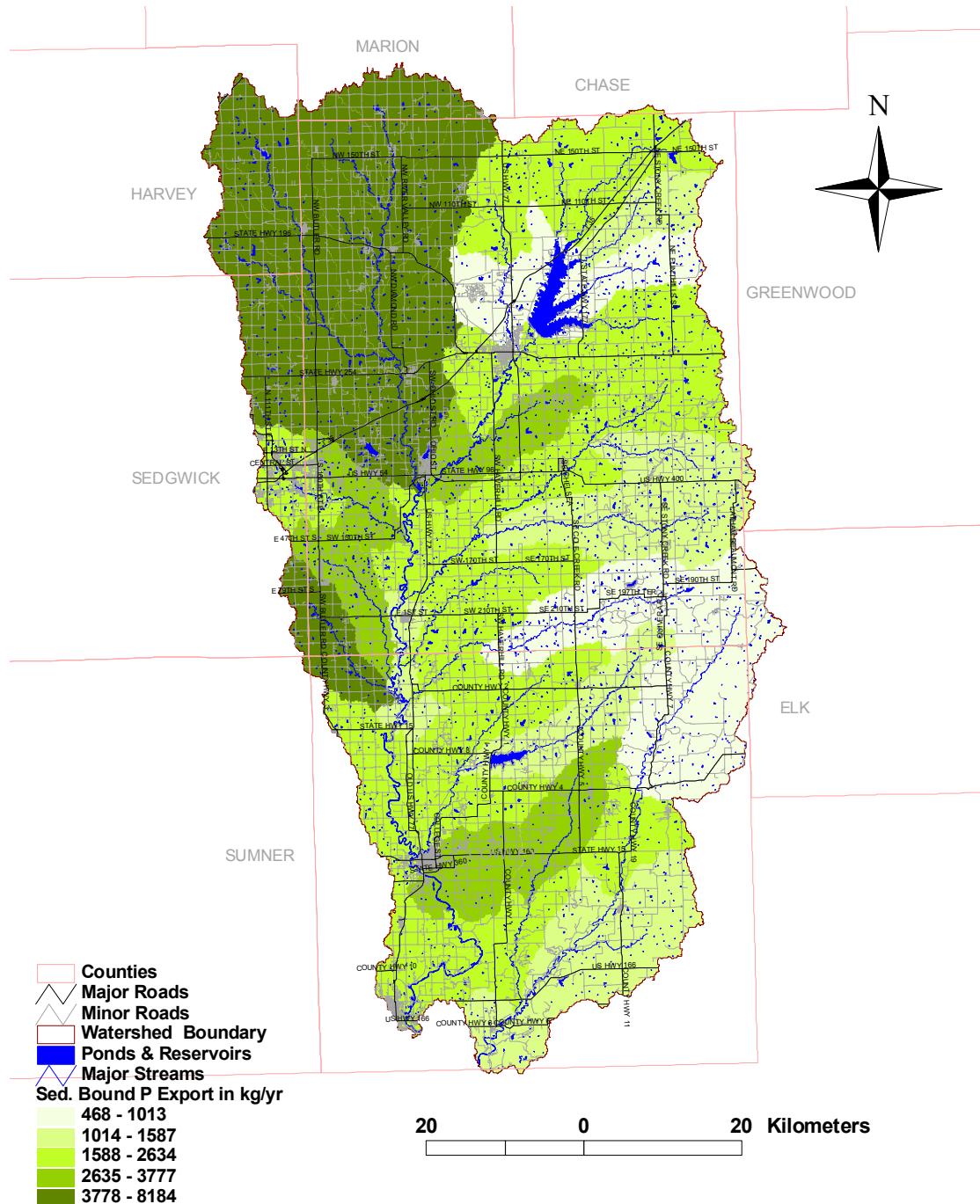
Figure 22. Simulated average annual sediment yield in metric tons by 14-Digit HUC.



**Figure 23.** Simulated average annual organic nitrogen as N yield in kilograms per year by 14-Digit HUC.



**Figure 24.** Simulated average annual organic phosphorus as P yield in kilograms per year by 14-Digit HUC.



**Figure 25.** Simulated average annual sediment bound phosphorus as P yield in kilograms per year by 14-Digit HUC.

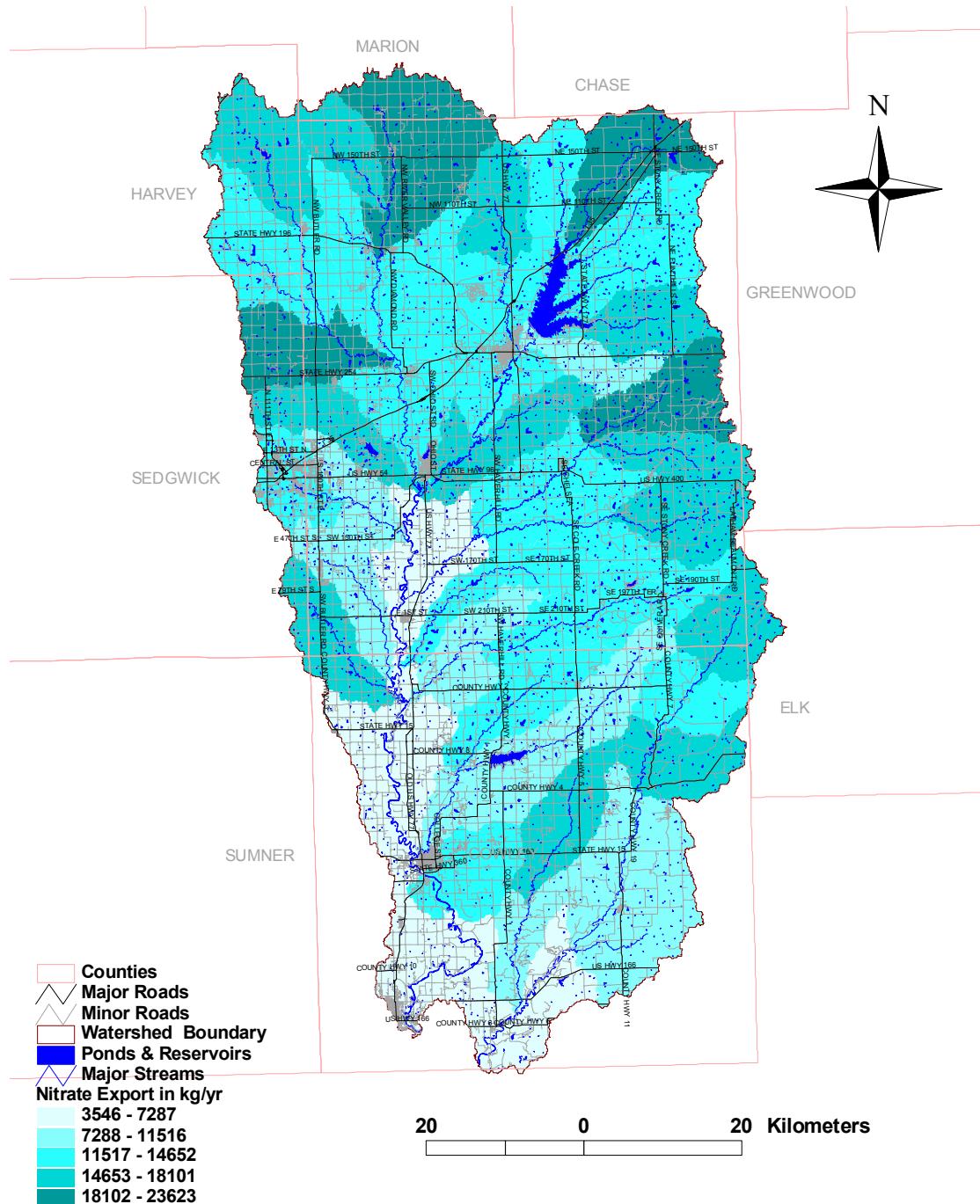
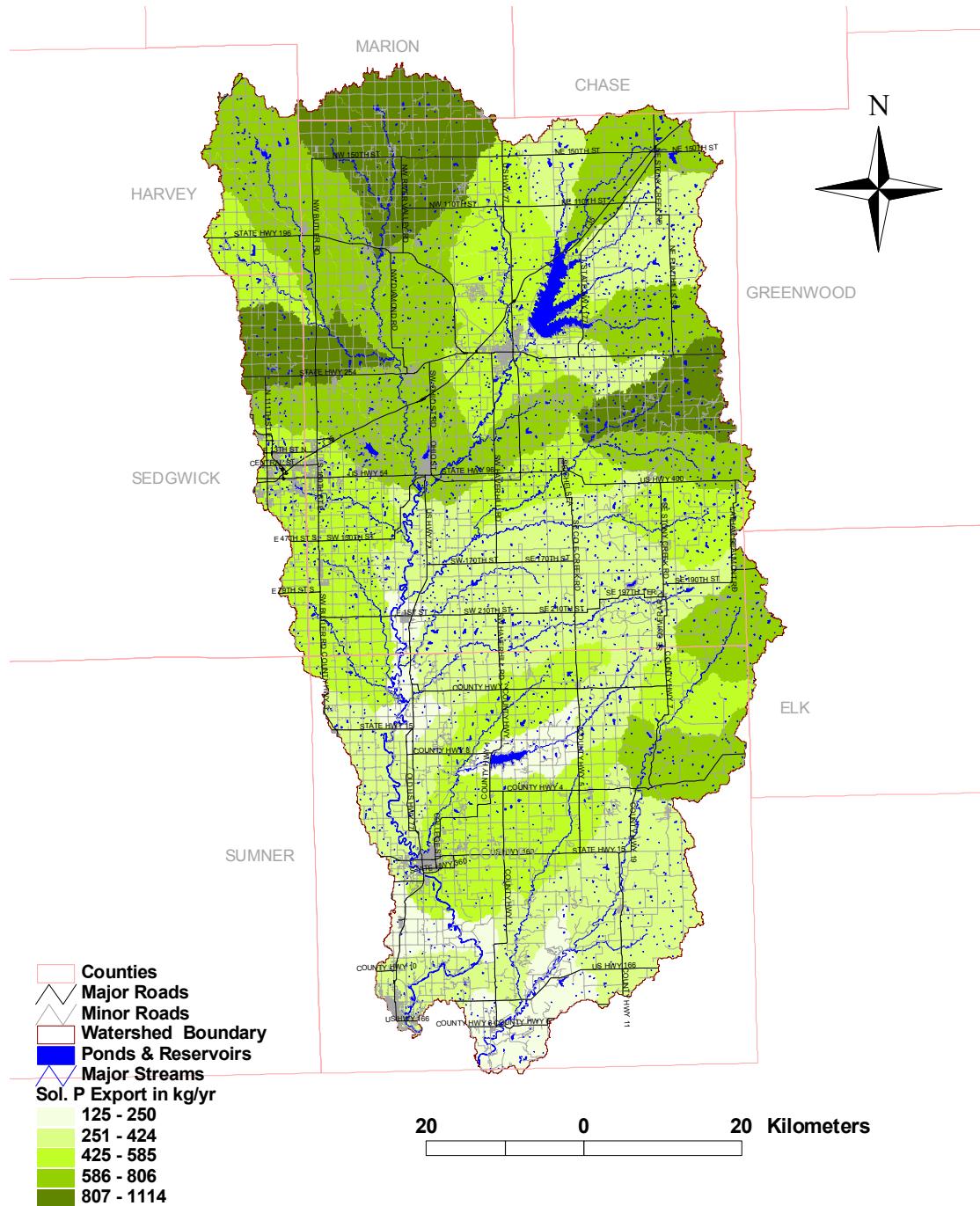
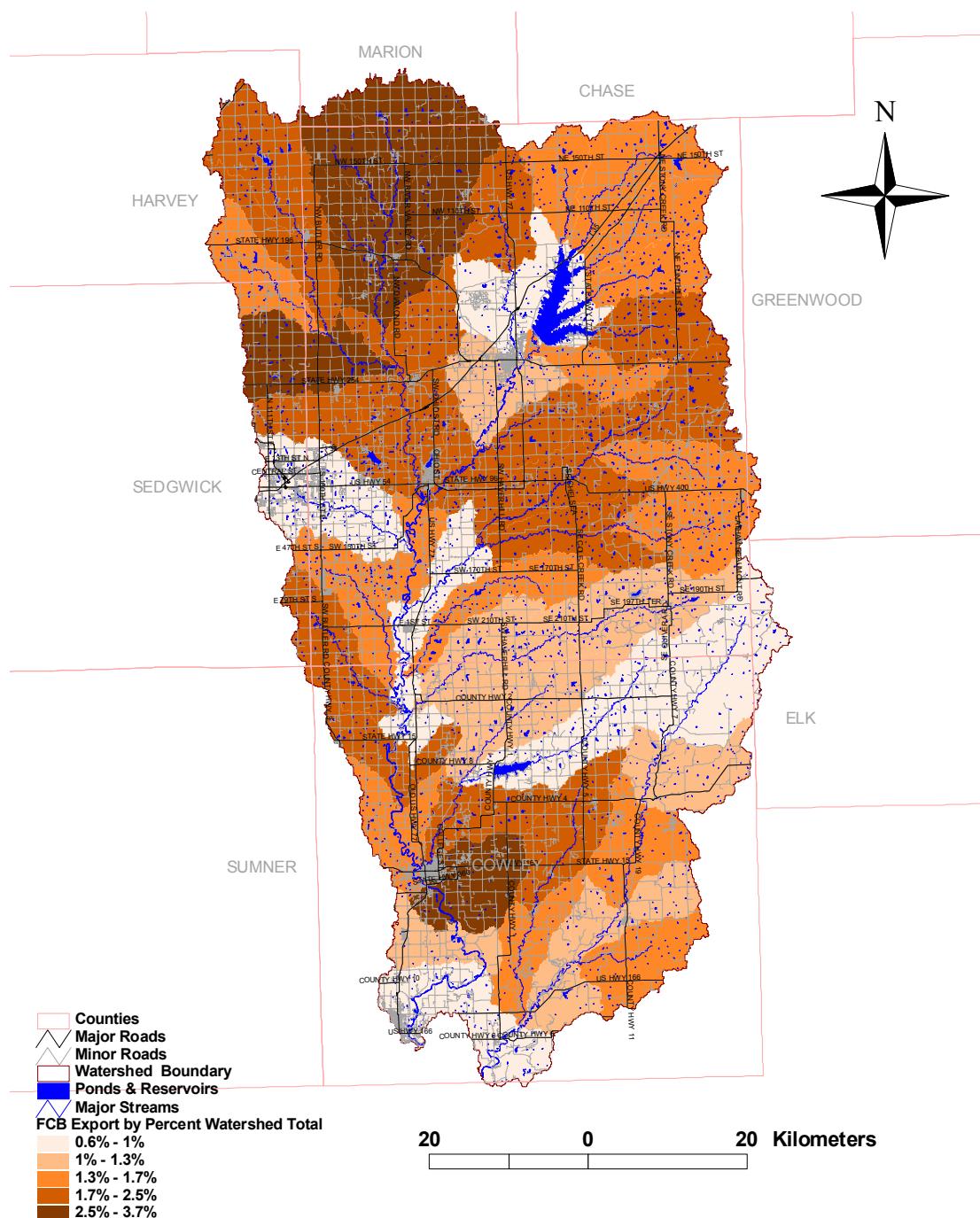


Figure 26. Simulated average annual nitrate as N yield in kilograms per year by 14-Digit HUC.



**Figure 27.** Simulated average annual soluble phosphorus as P yield in kilograms per year by 14-Digit HUC.



**Figure 28.** Simulated average annual Fecal Coliform Bacteria export by percent total watershed Fecal Coliform Bacteria export by 14-Digit HUC.